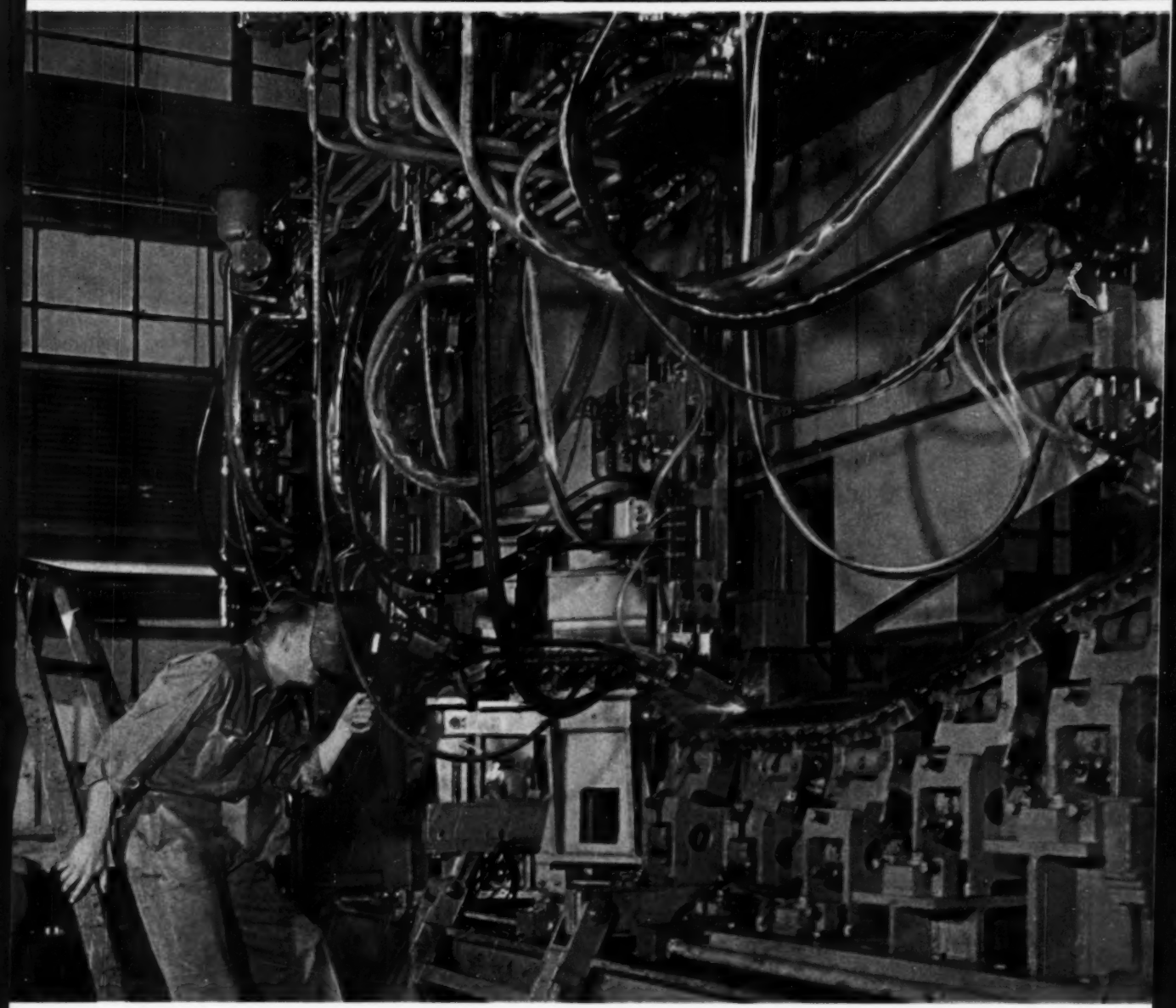
American Machinist

OCTOBER 6, 1958 75¢

McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

Machine code streamlines production routing

see page 92



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it's mainly a matter of TIMING!

Q. ***WHEN should you replace a machine?***

A. ***When you can do it at a PROFIT!***

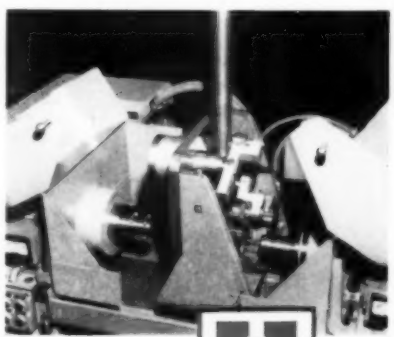
Obsolescence is an insidious thing. It can overtake any machine—even a relatively new one—without warning. And when it does, you're producing at a *loss*.

The only way to catch it in *time* is to make frequent studies, comparing the production cost of the old machine with that of the new one that might replace it. Then weigh these costs in terms of investment and return. Up to a certain point, the old machine will still be profitable to operate. Beyond that point, it's running *in the red*.

Heald sales engineers are well experienced in precise methods of replacement analysis. And they will be glad to help you determine when you can replace an existing machine *at a profit*. Similar cost studies by Heald engineers have pointed the way to many important cost savings.

For example: This new Heald Model 322 Bore-Matic replaced a heavy-duty drill for boring and chamfering hydraulic-cylinder piston rods. A cost analysis determined that the investment in a new machine could not be deferred any longer without serious financial loss. As verified by subsequent operation, the new machine offered the following savings:

	Old Machine	New Machine
Parts per hour	11	24
Machine load, per year	3,080 hrs.	1,380 hrs.
Direct & Indirect Labor	9,480 hrs.	3,240 hrs.
Annual Maintenance	$356	$100
Annual Operating Cost	$27,800	$15,000
Annual Saving, New Machine		**$12,800**
Net Return on Investment		39.6%



YOU pay for obsolescence. Replacement pays for itself!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

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American Machinist
McGRAW-HILL MAGAZINE OF METALWORKING PRODUCTION

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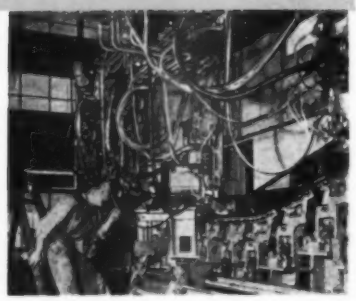
American Machinist chips



Cam inspection . . . A thorough study of the ways you can use to inspect both barrel and plate cams has been made by H A Rothbart at City College of New York. He summarizes these methods and goes on to provide a table of comparative accuracies for the various methods. You'll find it in page 97.

Inside Red China . . . This department was unable to take advance note of the exclusive story we published Sept 22 on the phenomenal advance being made by the metalworking industry in Red China. That we did not was simply because that story (which had been quietly in preparation for some time) was finished and moved into the Sept 22 issue after this page had gone to press. You'll find it the most detailed ever assembled on the state of industry in that enigmatic country and worth your attention.

Can Truth Be Exciting? . . . A common saying around editorial offices has it that certain subjects will not interest readers no matter how important they are. The real reason is undoubtedly not a lack of interest on the part of the reader, but a lack of fresh, informative ideas on the part of the writer.

No problem is more deadly serious today than that of keeping your equipment in such shape that production cost will be as low as possible. "Plan '59" calls on industry to modernize now for growth and profit, and Plan '59 issues of McGraw-Hill magazines are now beginning to appear. A seven-man task force on our staff is winding up its work on a Special Report that should get you excited about the hard facts of replacement and how to modernize your own plant. No project that we have ever undertaken is more timely or more important.

Coming . . . AM for October 20 will be our Plan '59 issue as described above. It will also be the Metal Show Issue. In addition to the Special Report on modernization you'll find articles on metal spray, heat treat, welding, and materials handling. There will be our Show-in-Print section describing the new equipment introduced at the show. All in all, you'd better reserve *two* evenings for this one.

Cover . . .

Automatic welding of side rail frames developed by Expert Welding Machine Co. Story on page 88.

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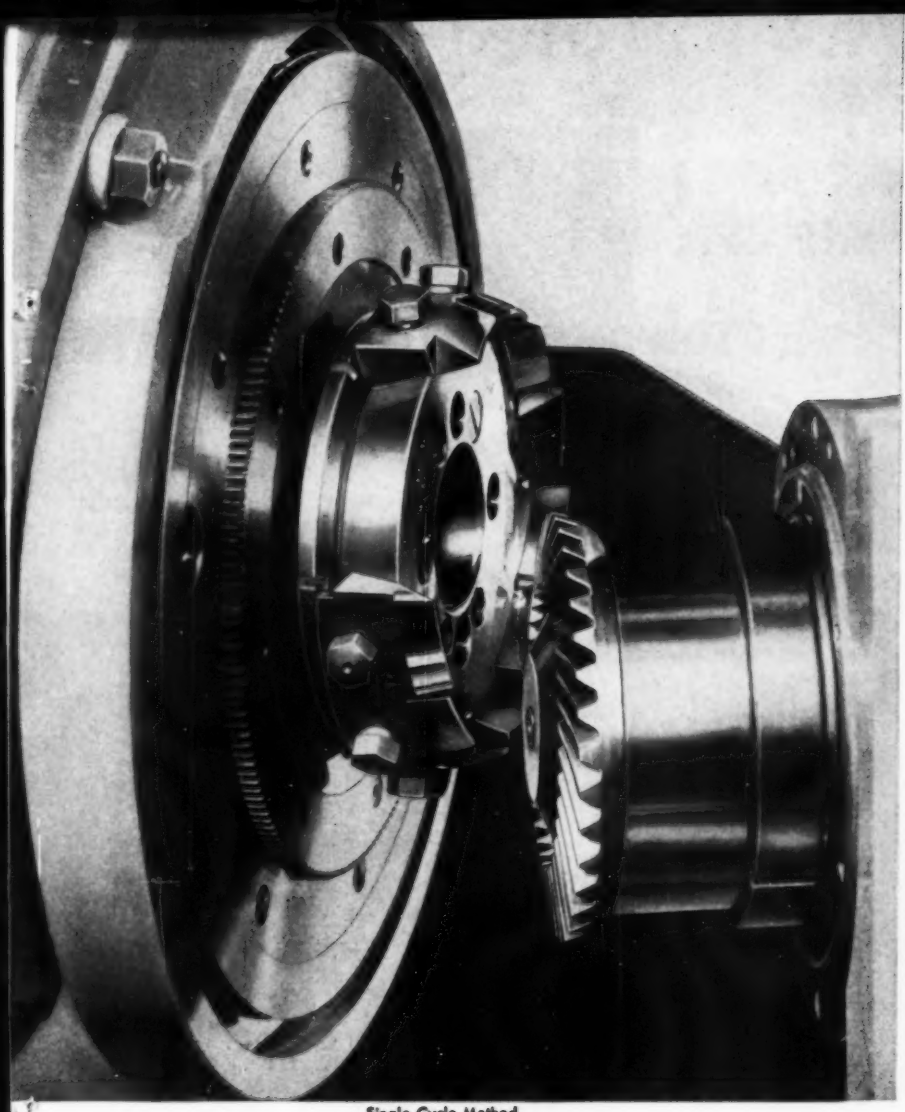
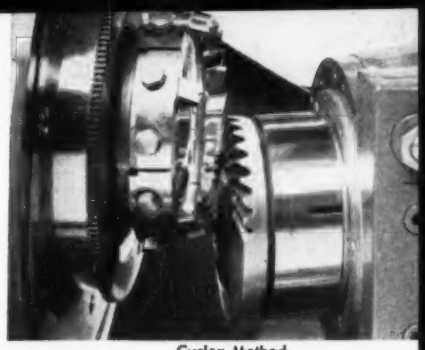
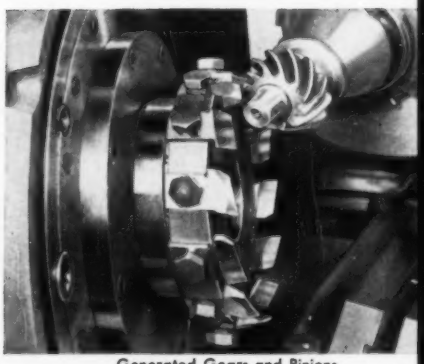


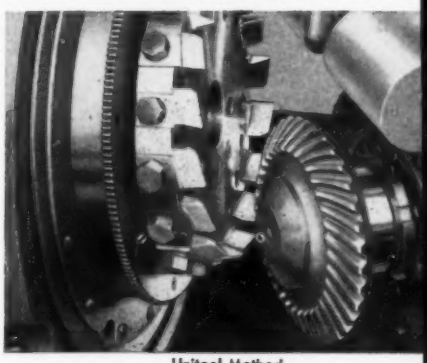
Single Cycle Method



Cyclex Method



Generated Gears and Pinions



Unitool Method

Cut gears with *four* different methods on *one* machine

If you expect your gear needs to change over the years you'll appreciate the exceptional versatility of the Gleason No. 108 Hypoid Generator. With this one machine you can cut both gears and pinions by four different methods:

Single Cycle® Method. Using this method you can cut nongenerated gears four to five times faster than previously possible on machines of this type. Cradle and work head are locked in position. The last rotation of the Single Cycle Cutter finishes both sides of a tooth space. You cut the mating pinions on the same machine using the conventional single-roll Generating Method.

Cyclex® Method. For certain applications you can use the extremely fast Cyclex Method on the No. 108 Generator. You cut nongenerated gears in one completing operation from the solid blank.

Generated Gears and Pinions. You can produce both gears and pinions on this machine with the Generating Method. Here, a relative rolling motion takes place between gear or pinion and the rotating cutter.

Unitool* Method. If you want to cut small quantities of spiral bevel, Zerol® bevel, or hypoid gears with a minimum of tooling, you can use the Unitool Method. You cut both gears and pinions with a single cutter. This method is particularly useful for experimental gears for prototype work.

The No. 108 Generator cuts gears up to 8½" diameter at a 10:1 ratio and to a maximum of 4 DP. You can get the same versatility in cutting larger gears with the No. 118 Hypoid Generator which handles gears up to 18" diameter, 10:1 ratio, to a maximum of 2 DP. A third model, the No. 28 Hypoid Generator, cuts gears up to 33" diameter at 10:1 ratio, 1½ DP.

Send for free bulletins on all three machines.

*Trademark

GLEASON WORKS

Builders of bevel gear machinery for over 90 years

1000 UNIVERSITY AVE., ROCHESTER 3, N.Y.

CIRCLE 201 READER SERVICE CARD

WHEREVER CHIPS ARE CUT..

..THEY'RE CUT CINCINNATI

Stagger tooth slotting cutters are accurately ground in the twinkling of an eye on CINCINNATI Cutter and Tool Grinding Machines. This setup is on a No. 1.

CINCINNATI® Knee Type Milling Machines • Bed Type Milling Machines

CIRCLE 202 READER SERVICE CARD

FASTER with cutters ground on

Cutter and Tool Grinders

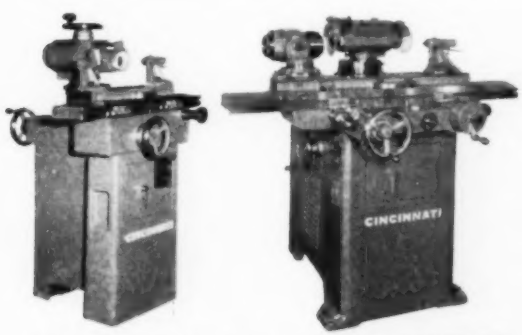
Cutter grinding puts life into every metal cutting operation. And as the speed of metal cutting increases, the stature of cutter grinding grows in importance. Cincinnati has long recognized this relationship, and actively promotes efficient metal cutting through research and by building the world's finest Cutter and Tool Grinders. ¶The Nos. 1 and 2 sizes are designed to accurately and quickly grind a variety of cutters such as helical, dovetail, keyway, circular saws, reamers, end mills, planer tools, etc. Quite naturally, the foregoing variety of cutters requires a high degree of versatility, and Cincinnati has it.

Ball bearing anti-friction table slide . . . eccentric swivel mounted wheelhead for 360° positioning and extra range . . . duplicate four-position operating controls . . . large graduated clearance setting dials . . . "Tange Bar" convenient taper setting device . . . dozens of attachments and accessories.

Grind your cutters on CINCINNATIS and see cutter maintenance cost decrease and metal cutting efficiency improve. Get the full story in catalogs No. M-1852-2 and No. M-2004. Brief specifications in Sweet's Machine Tool File.

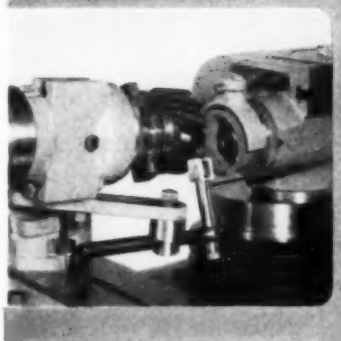
Brief specifications

Size	No. 1	No. 2
Swing over table	8"	10"
Length of work, between tailstock centers	15"	27"
Range: longitudinal	10"	16"
cross	4½"	8"



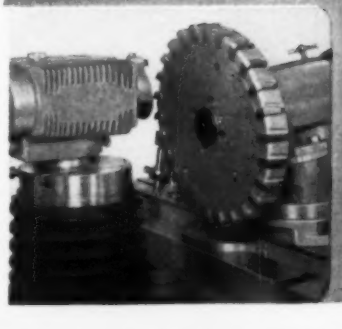
CINCINNATI CUTTER AND TOOL GRINDERS
No. 1 *(left)* Catalog No. M-1852-2
No. 2 *(right)* Catalog No. M-2004

Ball nose cutter, ground with the aid of a Radius Grinding Attachment mounted on a CINCINNATI No. 1.



Shell end mill cutters are ground in position on their arbors. This cutter is being ground on a No. 2 CINCINNATI.

Taper reamers, most demanding of all, are given the highest quality grind on a CINCINNATI. The setup is on a No. 2.



Heavyweight 18" diameter face mills can't hamper the smoothness and ease of traversing the table. The No. 2 handles these large cutters.

Die Sinking Machines • Cutter and Tool Grinders

Milling Machine Division
THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

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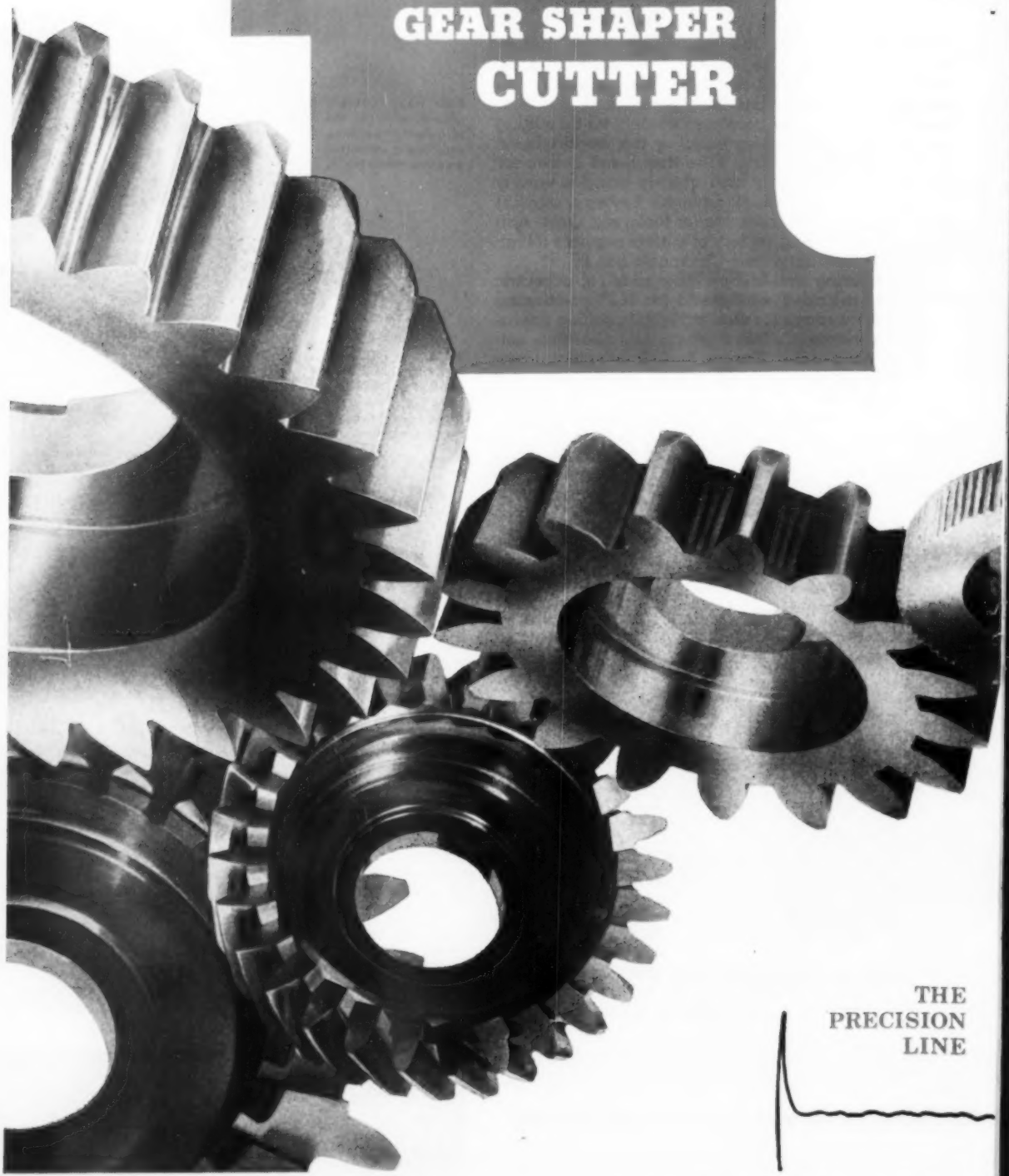
1 FELLOWS MADE THE FIRST GEAR SHAPER CUTTER

. . . and



THE PRECISION LINE

CIRCLE 204 READER SERVICE CARD

FELLOWS
still makes the BEST

The Fellows Cutters you order today have unequalled experience behind their manufacture: the first gear shaper cutter ever made was designed, produced and patented by Fellows in 1897. Hundreds of thousands of Fellows Cutters have been made and used on gear production lines since that time.

This vast experience has resulted in constant progress, year after year, in cutter design and manufacture. Today, new gear and cutter designs are checked on a high-speed electronic computer which permits complete mathematical study of all possibilities. Constant advances in metallurgy and in manufacturing methods assure outstanding cutter performance on every gear production job.

A booklet, "Fellows Gear Shaper Cutters", covers the subject in detail. It includes tables of stock cutters, design considerations, sharpening methods, and other information. For a copy, contact any Fellows office.

THE FELLOWS GEAR SHAPER COMPANY
78 River Street, Springfield, Vermont
Branch Offices: 1048 North Woodward Avenue, Royal Oak, Mich.
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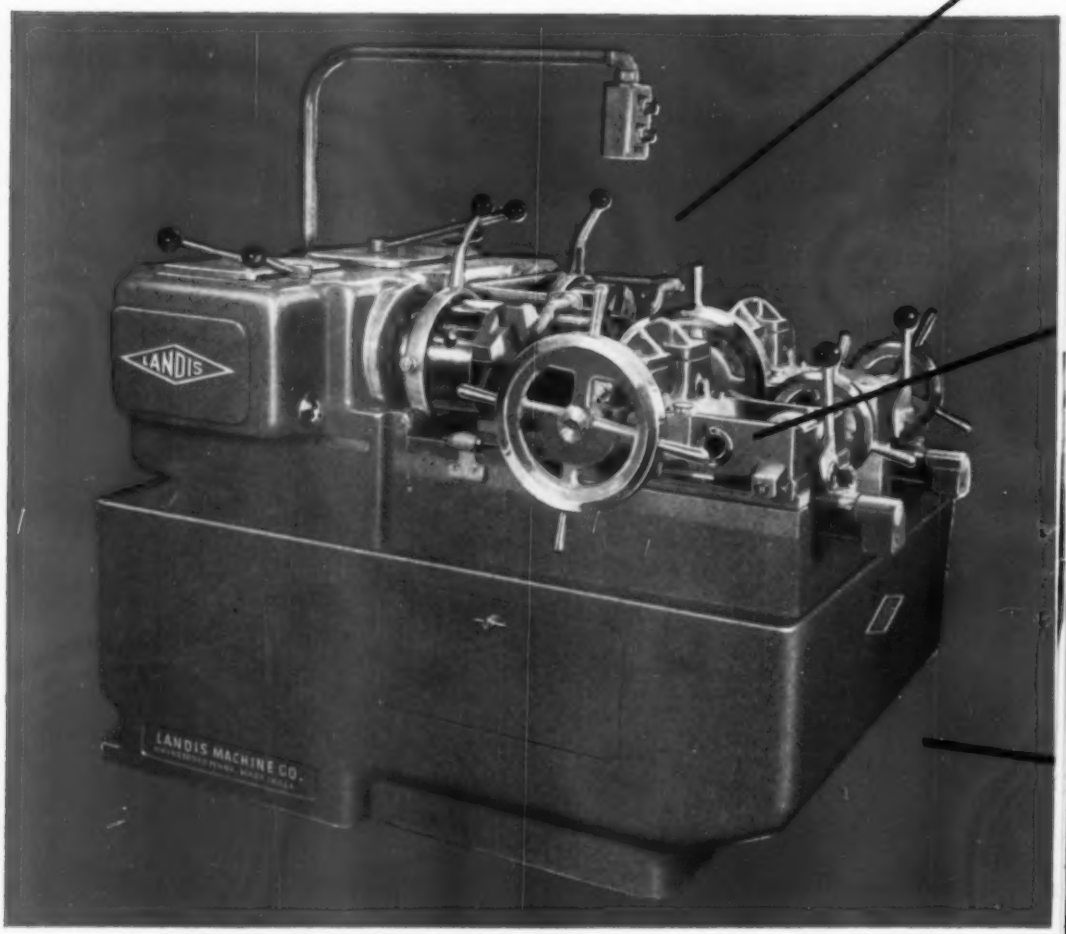
Fellows *Gear Production Equipment*

LANDMACO

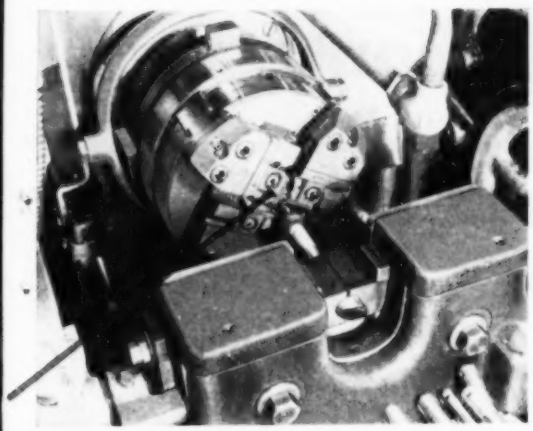
threading machines



. . . . . are built in a wide variety of models for commercial, heavy duty, and precision threading from 3/16" to 2½" in diameter.
Single or double-spindle models are available in varying bed lengths, with or without lead screw, using either of two die head styles, according to individual requirements. The die heads use LANDIS Tangential Chasers, which may be reground for 80% of their original length. Adaptation for oversize capacity and special jobs is easily made through auxiliary equipment.

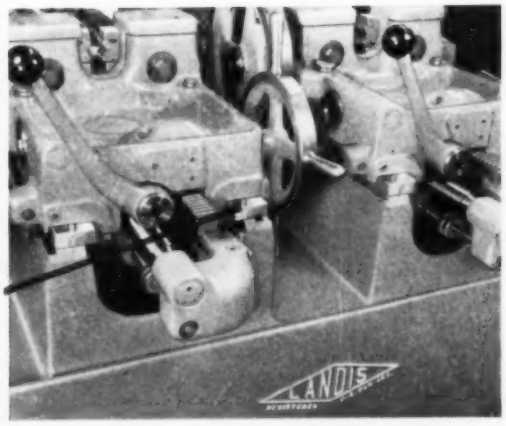
For more information, send specifications and ask for Bulletin H-76.

464C-2



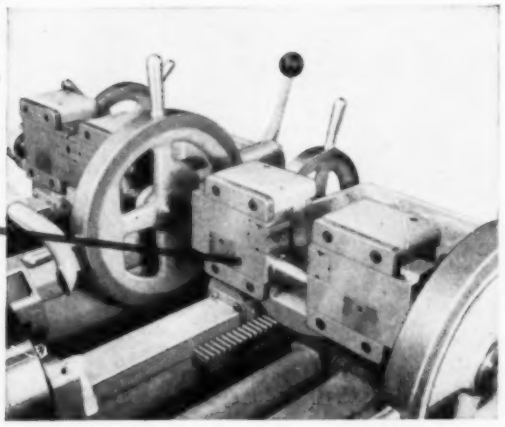
PRECISION

Hardened and Ground LANCO Die Heads combined with Lead Screw Feed enable threading to Class 4 and Class 7 tolerances. The fundamental design and specially selected and hardened materials of the die head provide the maximum rigidity required for this class work.



HEAVY-DUTY

Lead Screw Feed and rugged LANCO Heat Treated Die Heads enable the unusually heavy cuts required for producing Acme threads. Despite the heavy rate of metal removal, workpiece slippage is prevented by vise gripping power intensified by a "hammer blow" operating handwheel.

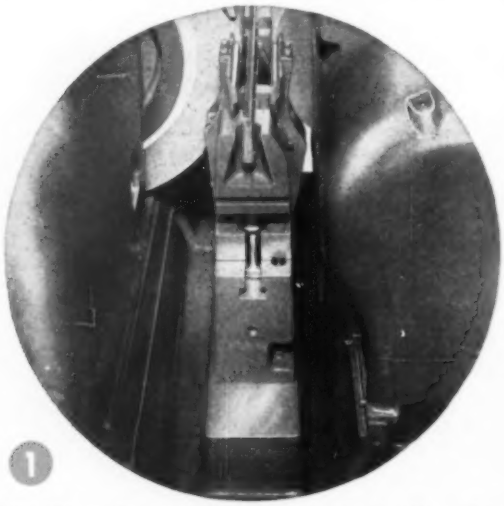


VERSATILITY

Each LANDMACO Threading Machine cuts a wide range of thread diameters—for example, the 12C LANDMACO has a standard threading range from $\frac{3}{8}$" to $1\frac{1}{2}$" in diameter, with oversize capacity to $3\frac{3}{4}$" for short thread lengths. Standard carriage vises enable the gripping of diameters larger than the machine's capacity, and special vises may be furnished. Tooling is available for Tapping, Turning, Grooving, Forming, and Facing operations.

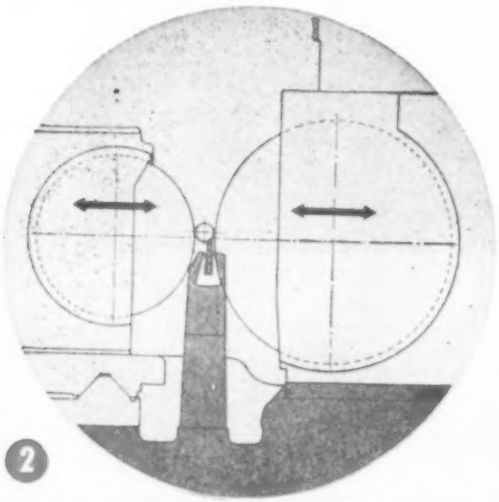
LANDIS *Machine* COMPANY
WAYNESBORO • PENNSYLVANIA

4 reasons why Landis centerless



1

"Rigid" work rest Solid support permits extra heavy cuts without loss of accuracy or finish.



2

Landis method of centerless grinding Work positioned on rigid work rest—Grinding and Regulating Wheel Heads slide on hand scraped ways.

3

Completely adjustable regulating wheel head

a. Tilt adjustment
b. Swivel adjustment
c. Wheel feed handwheel
d. Wheel aligning screw

4

***Both* grinding and regulating wheel spindles have Microsphere bearings** For fast spark-out . . . close tolerances . . . fine finishes

LANDIS

precision grinders

CIRCLE 208 READER SERVICE CARD

grinders lower production cost

No. 12 Centerless Grinder

LANDIS TOOL COMPANY / WAYNESBORO, PENNSYLVANIA

CIRCLE 209 READER SERVICE CARD

NEW

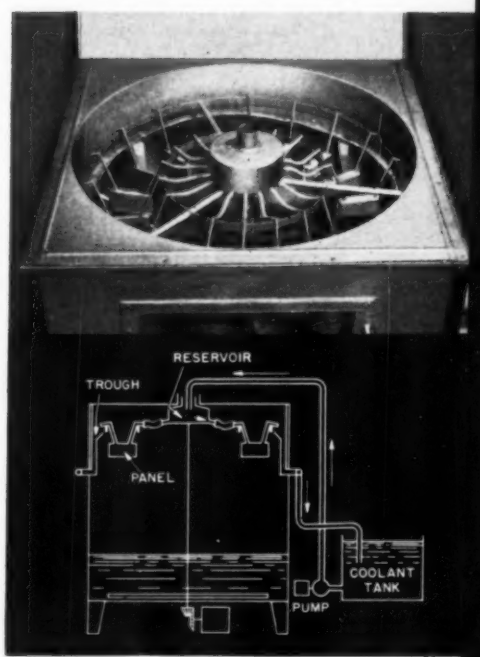
from Standard Oil THE MAGIC BOX

Corrosion steals $5.5 billion from industry annually. Standard Oil is in the forefront of the fight to control this loss. Standard's research scientists have developed a new method for measuring the effectiveness of rust preventives. This new test takes less than one-twentieth of the time of previous tests—and is about three times as precise.

Using a controlled humidity cabinet for testing corrosion, these Standard research men installed a system for cooling metal test panels (previously treated with rust preventive) so that their surface temperatures are lower than the temperature in the cabinet. Temperatures of panel surfaces and of cabinet atmosphere are held accurately. Controlling the temperature of the panels controls the rate at which water condenses on them. This in turn (for the first time) permits accurate control of the amount of condensation on the panels. Rust preventives are more speedily and precisely tested. Science, as a result of this work, has a new tool with which to test corrosion.

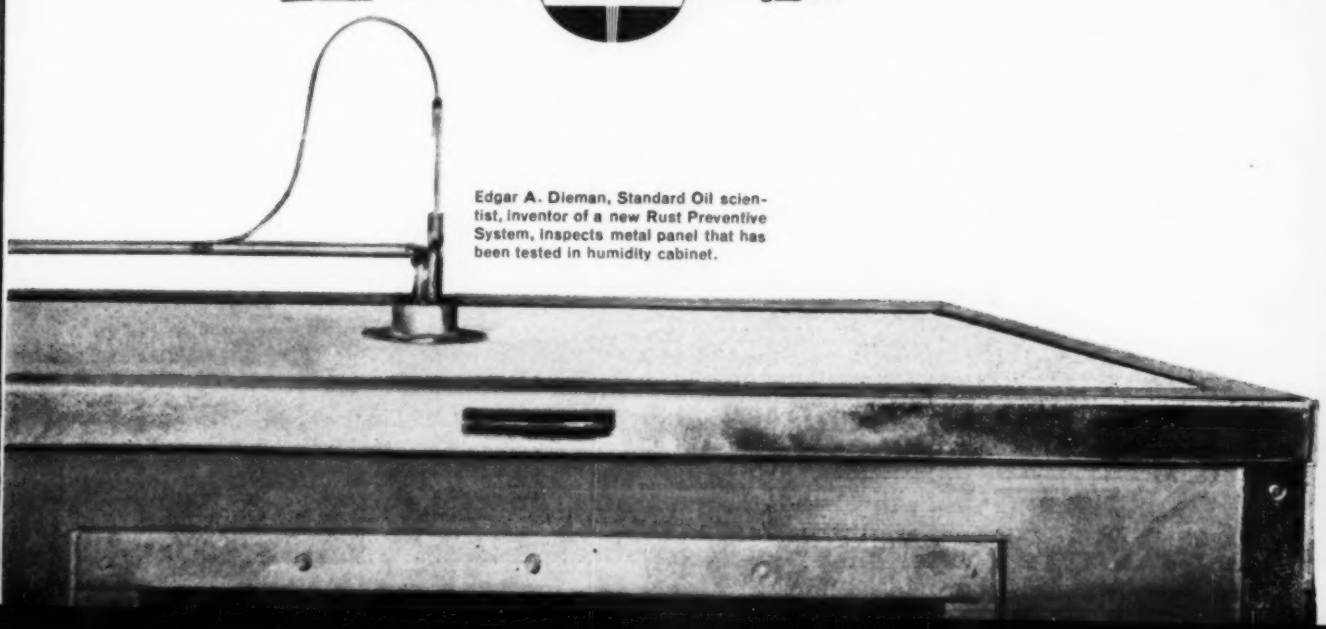
This is the research pay-out industry receives from Standard Oil. This is the something extra that backs up the Standard Oil industrial lubrication specialist who calls on you. This is the something extra found in the products he has to sell.

To know more about how Standard Oil industrial lubrication specialists—and Standard's research program—can help you, call the Standard Oil office nearest you in any of the 15 Midwest and Rocky Mountain states. Or write **Standard Oil Company (Indiana), 910 South Michigan Avenue, Chicago 80, Illinois.**



Top view and cross section of Accelerated Corrosion Test cabinet.

You expect more from STANDARD and get it!

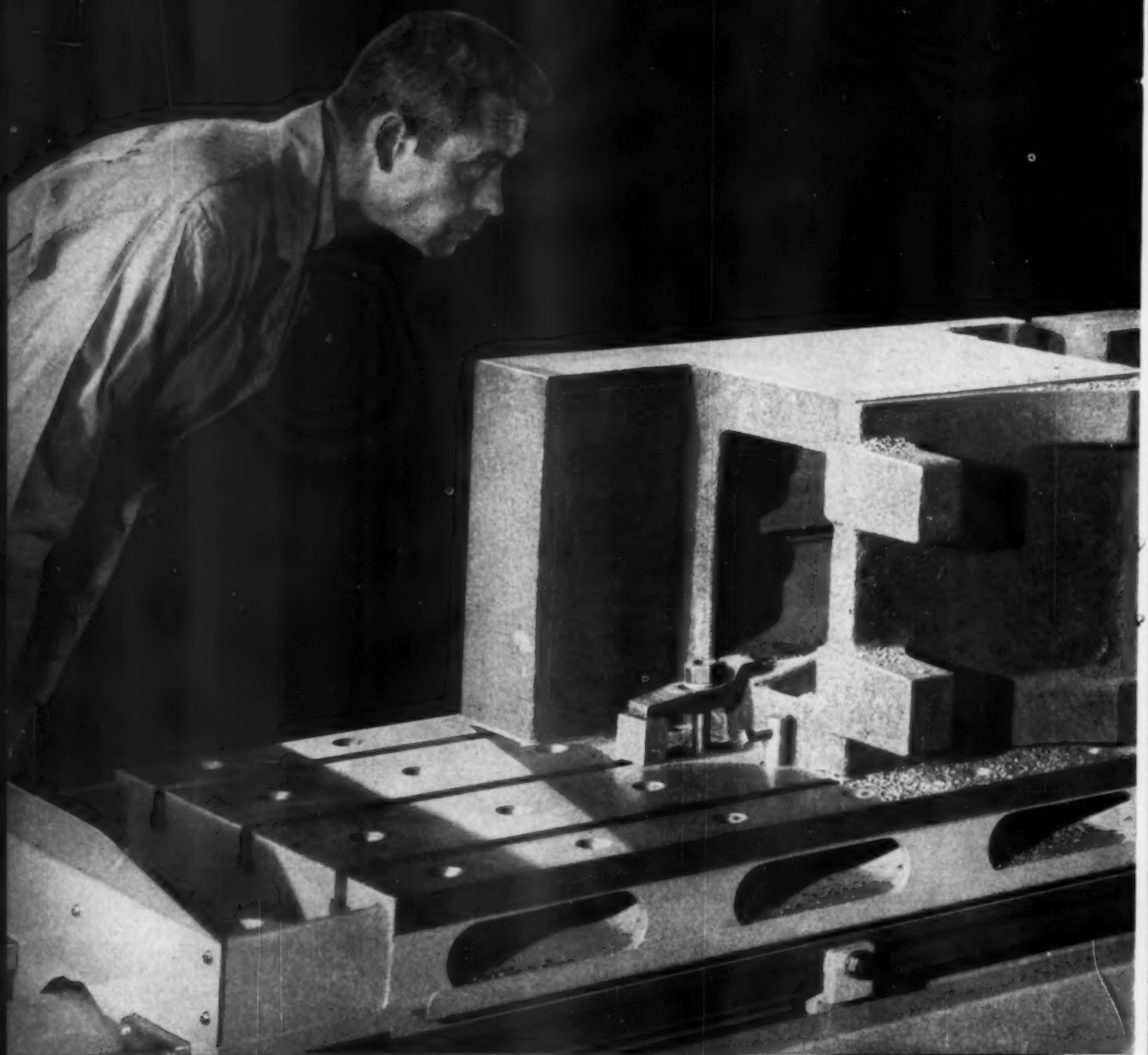


Edgar A. Dieman, Standard Oil scientist, inventor of a new Rust Preventive System, inspects metal panel that has been tested in humidity cabinet.

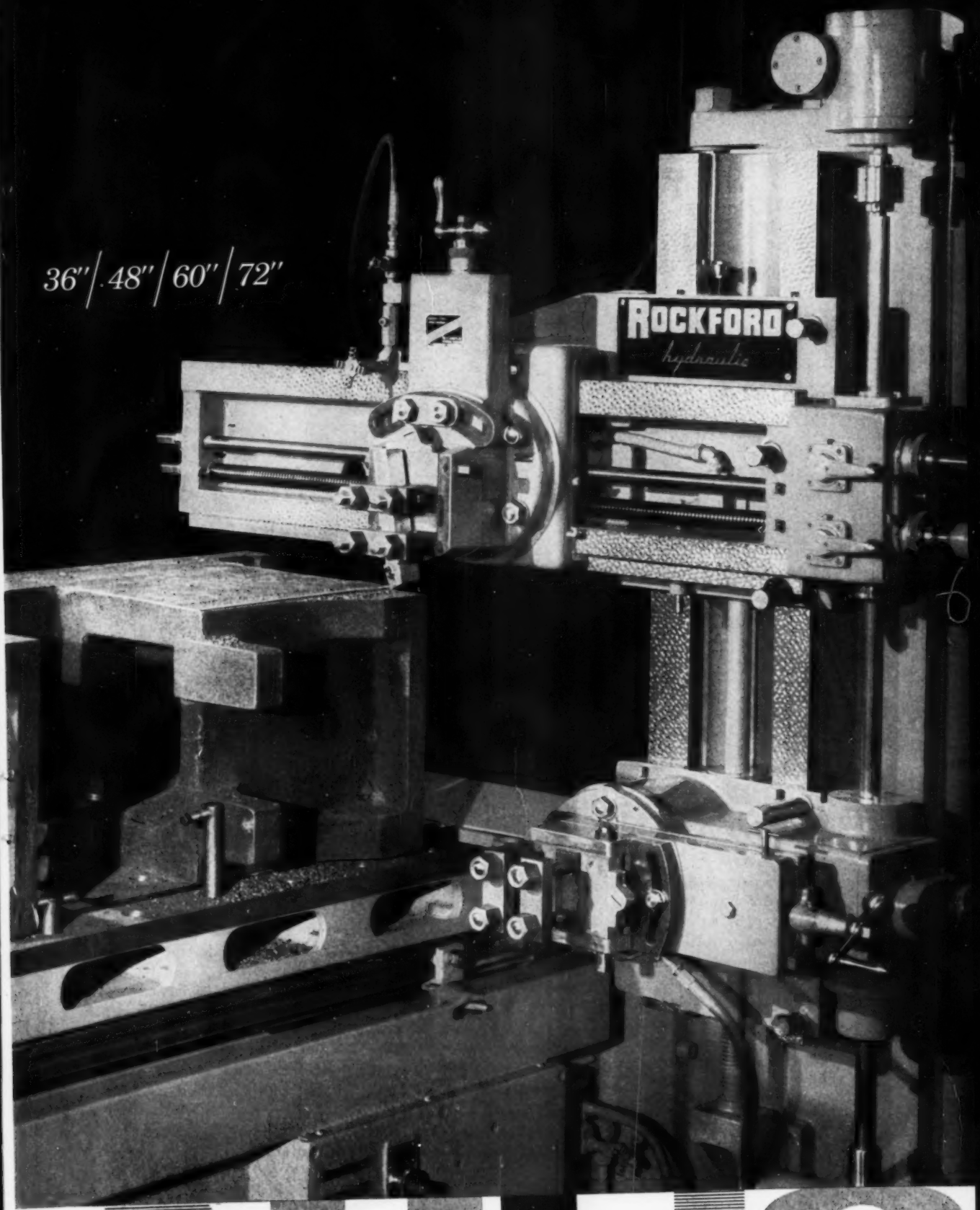
ROCKFORD MACHINE TOOL CO. 2500 KISHWAUKEE STREET ROCKFORD, ILLINOIS

DON'T SPEND BIG MONEY TO DO BIG JOBS!

Put them on a Rockford Hy-Draulic Openside Shaper



HY-DR



AULIC

New design in Sigma hand welding torches

Here is a new, lightweight torch—only 16 ounces—for manually welding light-gage steels. Sigma ST-2 welds in all positions with no change in control or current settings. Welds .030- to .100-in. sheet, using low-voltage short-arc technique with .020- and .030-in. hard-drawn wire. For 200 amp continuous service, a-c or d-c.

Balanced design makes handling easy. Service lines enter through rear of handle—a convenience in cramped quarters. Start-stop switch on handle, easy to reach. Nozzle has a 60° curve for maximum weld visibility.

Sigma ST-2 makes high-quality welds at high speed. Seams require no cleaning . . . distortion is at a minimum. Inert gas shielding is economical. Low flow rate—only 10 cu. ft. or less per hour—means even more savings.

Call your nearest LINDE office today for a demonstration of this new Sigma ST-2 torch! Or write Box AM10, LINDE COMPANY, Division of Union Carbide Corporation, 30 East 42nd Street, New York 17, N.Y. Offices in other principal cities. In Canada: Linde Company, Division of Union Carbide Canada Limited.

Linde TRADE-MARK UNION CARBIDE

"Linde" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

FROM 12½ HOURS... TO 4½ HOURS... plus BETTER FINISH

Bulletin No. 135 gives a complete description and shows many examples. It's yours for the asking.

R. Hoe & Co. Inc., New York world renowned manufacturers of printing presses, has actually accomplished this in the machining of their impression cylinders.

Using a 32" "AMERICAN" Hydraulic Tracing Lathe, the cylinder journal shapes are generated from a template and the 15" diameter cylinder body is turned straight without the template control.

The all-hydraulic tracing unit in combination with the accuracy and rigidity inherent in "AMERICAN" lathes insures the highest quality of work both from the standpoint of accuracy and fine finish.

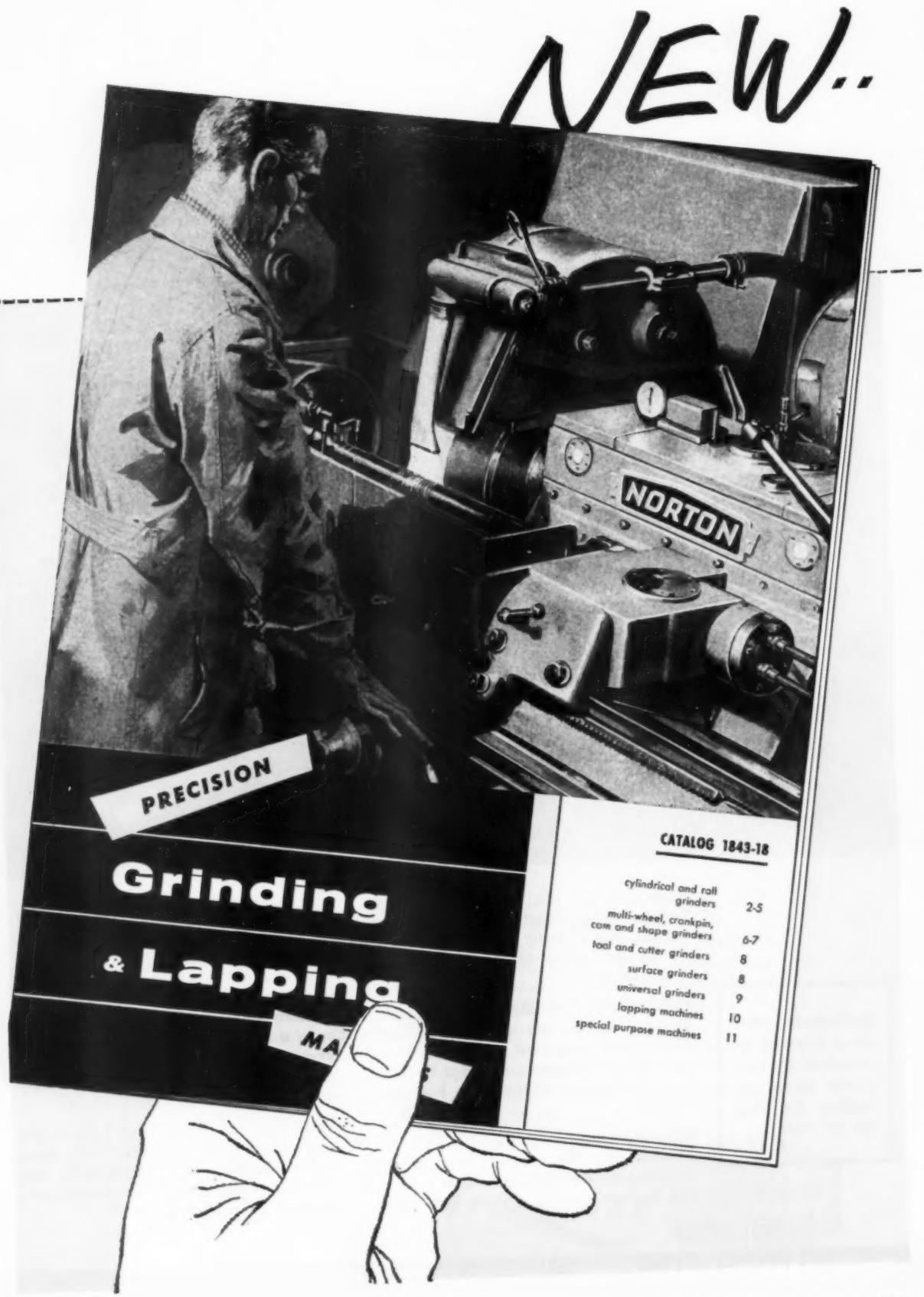
With production costs constantly reaching new peaks, industry simply can't afford to ignore such savings from modern equipment. Where else could such a magnificent return upon an investment be secured, and how else can costs be lowered to meet an increasingly competitive market?

More production per man hour is the answer and the only answer to spiraling costs—modern, high production machinery is the answer to greater production per man hour.

THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS

CIRCLE 215 READER SERVICE CARD


NEW..
NORTON
PRECISION
Grinding
& Lapping
CATALOG 1843-18
cylindrical and roll grinders 2-5
multi-wheel, crankpin, cam and shape grinders 6-7
tool and cutter grinders 8
surface grinders 8
universal grinders 9
lapping machines 10
special purpose machines 11

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MACHINES ENGINEERED TO HELP YOU MEET COMPETITION

Norton Catalog No. 1843-18 — just published — describes and illustrates the world's most complete, most modern line of grinders and lappers. This includes cylindricals, angulars, surface, universals, tool and cutter, flat and cylindrical lappers and special types of machines for grinding pistons, valves, jet parts, etc. And remember: only Norton offers you such long experience in both grinding machines and grinding wheels to bring you the "Touch of Gold" that helps you produce more at lower cost.

Get a free catalog from your Norton Representative. He'll also be glad to tell you about Norton Leasing and Financing Plans, that enable you to modernize while conserving capital. Or, for your catalog or any information, write direct to NORTON COMPANY, Machine Division, Worcester 6, Massachusetts.

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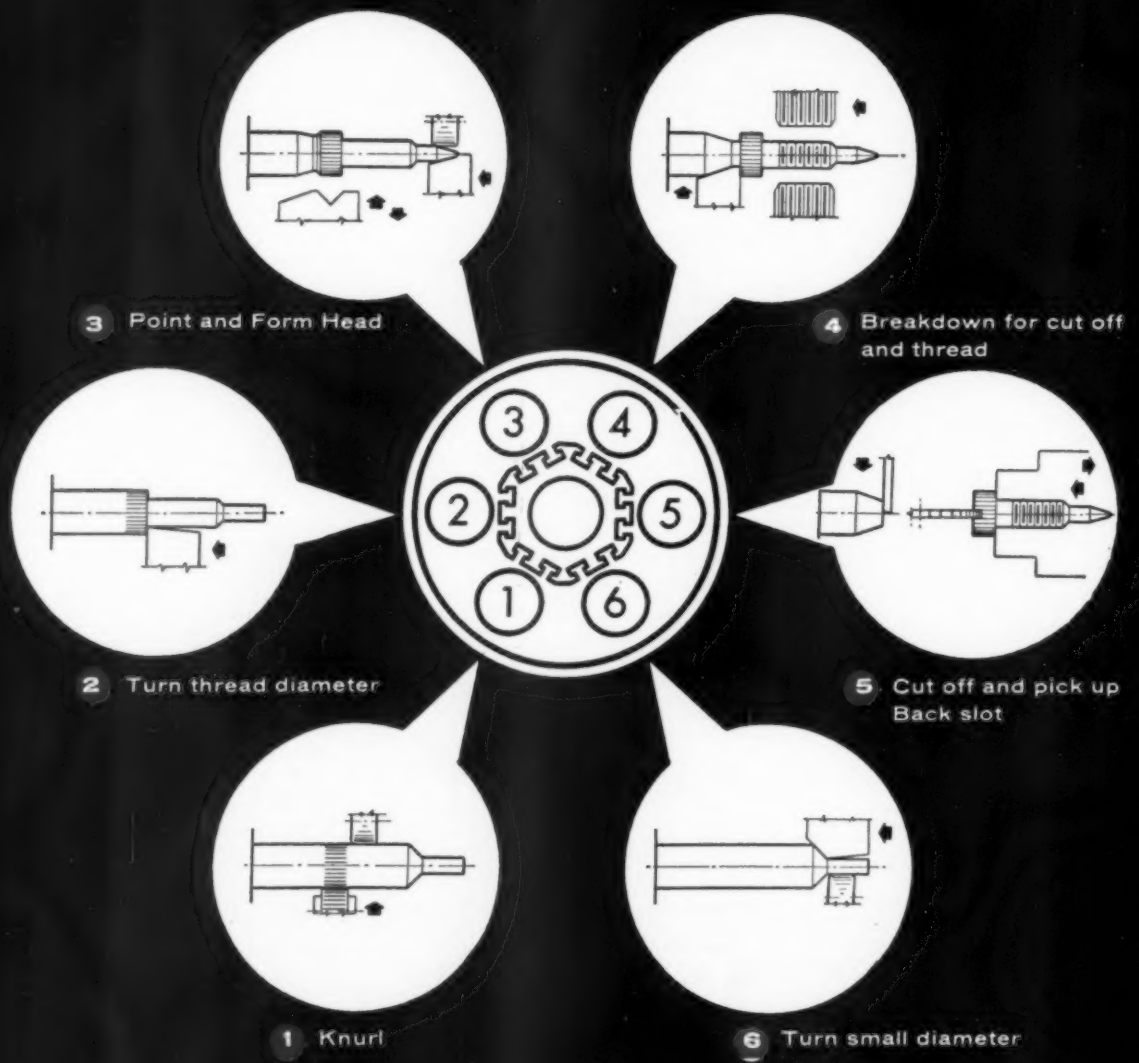
here's circumferential automation at work . . . . .



In this example of circumferential automation, 9 operations are performed in 3 seconds to complete this carbureter idle adjustment screw. This part and thousands of others, many more complex, are produced to close tolerances, at high speeds and low costs on Acme-Gridley automatics.

circumferential automation *

pioneered by National Acme, saves floor space, reduces machine tool investment, lowers machining costs.

* Each spindle on an Acme-Gridley Automatic is an efficient work station where pre-sequenced operations are performed in succession without manual attention. This is automation . . . circumferential automation.

Circumferential Automation, inherent in all Acme-Gridleys since 1893, goes other forms of automation one step better. Instead of a line of machines, transfer devices and other space-consuming equipment, Acme-Gridley Multiple Spindle Automatics provide for maximum automatic production in a *single machine*. This means you save floor space, machine investment and man-hours.

Acme-Gridley Automatics with their "wide open" tooling zone provide maximum machining flexibility. Their extra heavy, extra sturdy "box" construction assures day-in, day-out production with minimum human attention.

Let us show you how Circumferential Automation can go to work for you—speed your production, improve production quality *and* lower your unit cost. Our representative will be glad to call without obligation

National Acme

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All 'round the world where there's work to be done
and time to be saved there's an Acme-Gridley to do it.

NOW... Get One-Day Service from our Authorized Distributor on

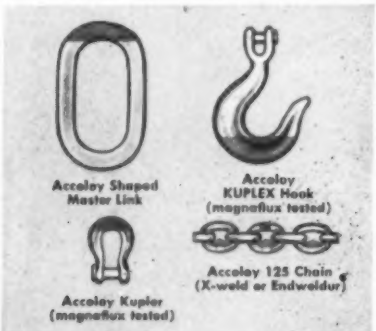
NEW ACCOLOY KUPLEX SLING CHAINS

• Imagine . . . you can now get ***one-day delivery service*** on ACCOLOY KUPLEX Chain Slings like you see here from our nearby Authorized KUPLEX distributor! This really remarkable development in speedy sling service is made possible by the new KUPLEX coast-to-coast system of localized service to meet your sling chain needs. No more waiting around for shipments from the factory . . . no more returning damaged slings to the factory for repairs. Our KUPLEX distributor is equipped to offer you both of these valuable services, and he's as near to you as your telephone.

KUPLEX is a modern sling chain that has been tried and proved through thousands of applications. Its streamlined form greatly reduces the chance of snagging on other objects. KUPLEX Sling Chains are assembled from genuine ACCOLOY KUPLEX component parts which have been factory proof-tested at twice their specified load limits. Each part is designed and manufactured specifically for use with all other parts of the complete KUPLEX sling assembly. These matched components are made to ACCO *Registered* Specifications from heat treated ACCOLOY steel, and are engineered to be as strong as the chain itself. Hooks and Kuplers are magnaflux-tested. In addition, you are assured of complete safety—with genuine component parts—by a **CERTIFICATE OF TEST** issued by ACCO and signed by the distributor with each complete sling purchase.

• • •

Write our York, Pa., office for the name of the Authorized Kuplex Sling Distributor nearest to you.


Accoloy Shaped Master Link
Accoloy KUPLEX Hook (magnaflux tested)
Accoloy 125 Chain (X-weld or Endweldur)
Accoloy Kuplor (magnaflux tested)

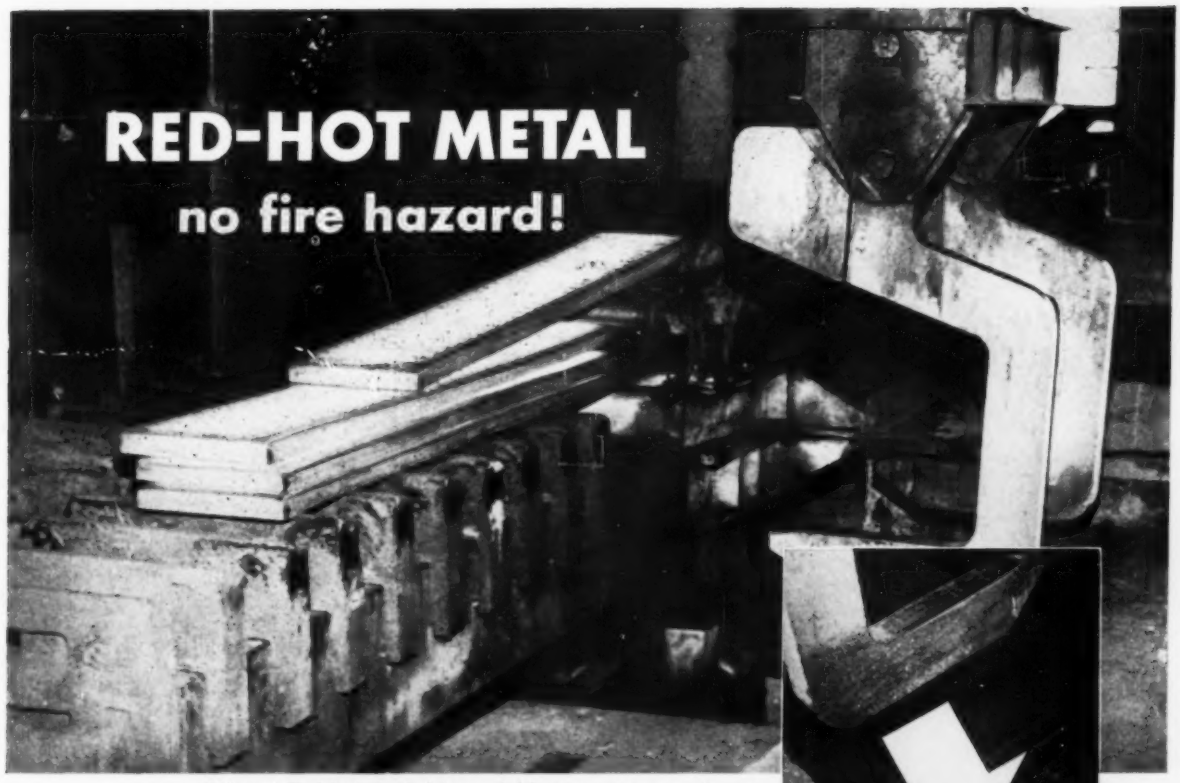
SIX CHAIN SIZES WITH THESE FOUR COMPONENTS

• A nearby Authorized ACCOLOY KUPLEX Sling Distributor can furnish promptly from his stock the exact sling chains you need for your specific requirements; made up from the components shown above. Six chain sizes (¼" through ⅞") are available in single, 2-leg, 3-leg or 4-leg styles.

American Chain Division
AMERICAN CHAIN & CABLE
Bridgeport, Conn. • Factories: *York and *Braddock, Pa.

Sales Offices: *Atlanta, Boston, *Chicago, *Denver, Detroit, *Houston, *Los Angeles, New York, Philadelphia, Pittsburgh, *Portland, Ore., *San Francisco
*Indicates Warehouse Stocks

ACCO
TRADE MARK



(Above) Red-hot steel slabs, weighing over 2 tons each, are at arm's length from hydraulic lines filled with Irus Fluid 902—YET NO FIRE HAZARD.

(Right) The distinctive yellow color of Irus Fluid makes it easy to spot and trace hydraulic line leaks.

"After numerous tests, we selected Shell Irus Fluid 902 because of its excellent fire resistance and low cost,"

says Norman Bracht, Lubrication Engineer, Alan Wood Steel Company, Conshohocken, Pa.

A fire in the strip mill, causing serious equipment damage and plant down time, convinced the Alan Wood Steel Company that a switchover to a fire-resistant hydraulic fluid was imperative. After extensive testing with various commercial types, Shell Irus Fluid 902 was selected. Now . . . twelve months later . . . Alan Wood is convinced that serious hydraulic fires in strip mill tilt table are a thing of the past.

Irus* Fluid 902 is a specially compounded water-in-oil emulsion which has exceptional fire resistance. Plant tests show, time after time, that Irus Fluid 902 *actually snuffs out fire!*

Many plant operators, like Alan Wood Steel, have discovered that Irus Fluid is economical . . . costing up to one-third less than other fire-resistant fluids, yet its performance is comparable in every practical respect.

If your present hydraulic equipment is vulnerable to accidental fire hazard, we suggest that you obtain complete technical information on Shell Irus Fluid 902. Write: Shell Oil Company, 50 West 50th Street, New York 20, N.Y. or 100 Bush Street, San Francisco 6, California.

*Registered Trademark

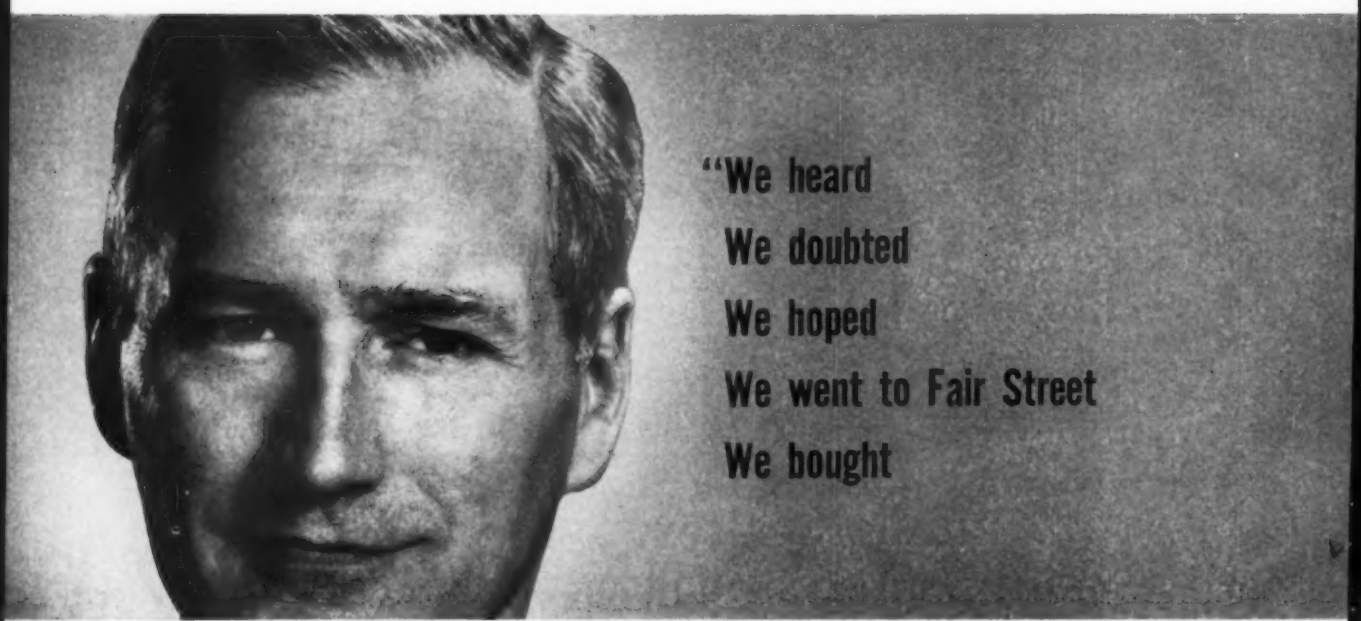
SHELL IRUS FLUID 902

a low-cost, fire-resistant hydraulic fluid

SHELL

C. J. GANO, Vice-President & Plant Manager,
Speco Division, Kelsey-Hayes Co.

a man who came to Fair Street



"Two more DeVlieg JIGMILS rapidly followed the first. Continued proof of precision, speed and versatility caused us to buy an additional two machines.

With our JIGMILS we no longer use an expensive machine as a planning desk. We no longer build expensive boring fixtures. The JIGMIL Technique solves these problems and saves both time and scrap.

Our DeVlieg JIGMILS give us the versatility needed in our 'Overgrown Job Shop.' We can make prototypes with the same accuracy as tooled jobs and continue our production without expensive retooling and loss of time."

C. J. GANO

DEVLIEG MACHINE COMPANY, FAIR STREET • **ROYAL OAK, MICHIGAN**

CIRCLE 222 READER SERVICE CARD

SOME OF OUR JIGMIL USERS

Adams Div., LeTourneau-Westinghouse Co.
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Allen Tool Corp.
American Machine & Foundry Co.
Andale Company
Baker-Perkins, Inc.
Bell Aircraft Corp.
Bendix Products Div. of Bendix Aviation Corp.
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Eclipse-Pioneer Div., Bendix Aviation Corp.
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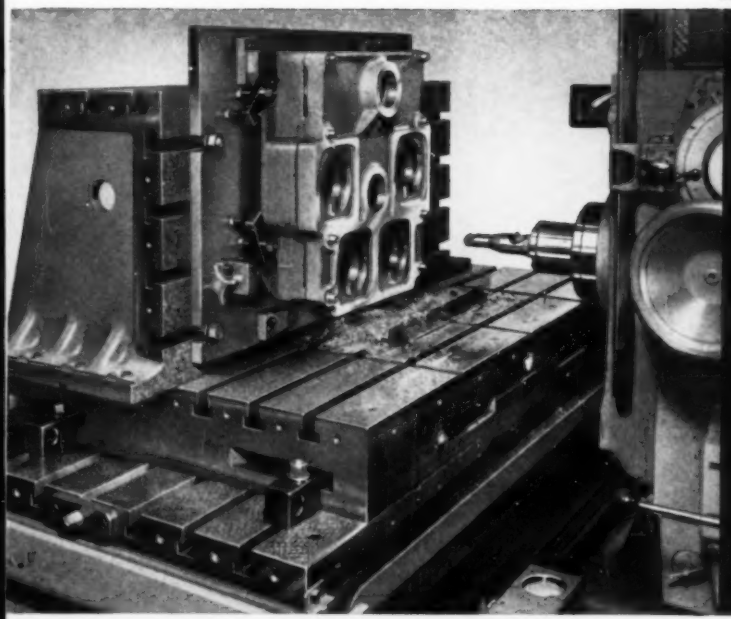
R. H. Freitag Mfg. Co.
Goodyear Tire & Rubber Co., Inc.
Halliburton Oil Well Cementing Co.
Heintz Div. Kelsey-Hayes Co.
Hughes Tool Co.



A FEW PROVEN ADVANTAGES OF THE JIGMIL TECHNIQUE

- Eliminates cost of expensive jigs and production delays resulting from their manufacture.
- Simplifies tooling.
- Employs automatic functions to reduce factors of human error even in close tolerance work.
- Makes possible greater flexibility of product design.
- Improves end product by permitting interchangeable assembly of parts without hand fitting.
- Increases production and product accuracy.

ACCURACY IS AN ECONOMY!

ANOTHER EXAMPLE OF JIGMIL PRECISION
applied to guided missile production

Speco Division, Kelsey-Hayes Co., uses the JIGMIL Technique to bore and mill to precise limits of accuracy a wide range of guided missile components such as the one above. Because of their speed, accuracy and versatility, Speco also uses its 5 JIGMILS in the production of such critical items as aircraft and helicopter transmissions, hydraulic control systems, radar antennas, rocket and jet engine precision gears and assemblies.

Improved Paper Machinery Corp.
McDonnell Aircraft Corp.
Mechanical Specialties Co.
Michigan Drill Head Co.
Oil Well Supply Div. U.S. Steel Corporation
Paramount Boring & Machine Co.
Princeton University, Forrestal Research Center
Rheem Mfg. Co.
Sandia Corp., Sandia Base, U.S. Atomic Energy Comm.
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Teppert Tool & Eng., Inc.
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Our newest catalog will help you decide. May we send it?

WILL YOU BE THE NEXT TO VISIT FAIR STREET

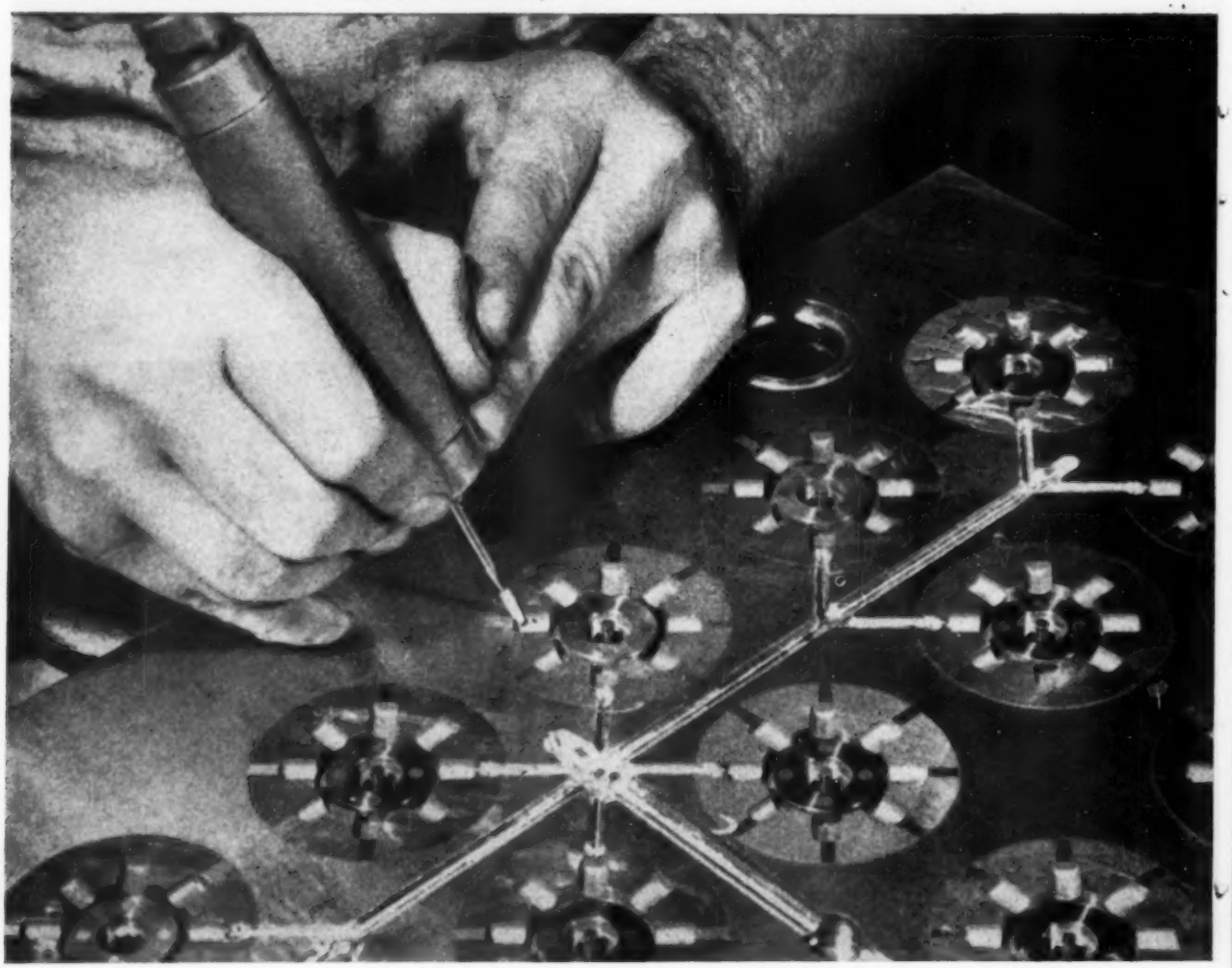
DeVlieg

SPIRAMATIC JIGMILS®

ACCURATE HOLES AND FLAT SURFACES IN PRECISE LOCATIONS

CIRCLE 223 READER SERVICE CARD

32 ALUNDUM Abrasive for your tool and die jobs*



Here's how Norton keeps

"Making better products... to make your products better"

Our motto is constantly being proved by our customers. Norton mounted wheels, for example, are hitting new highs in grinding efficiency. Outstanding new developments in abrasives and wheel construction eliminate loading and glazing, assuring best possible results in:

TOOL AND DIE GRINDING

Norton mounted wheels with sharp 32 ALUNDUM abrasive and VBE bond are the very best performers.

Advantages: Wheels need no costly dressing, hold form and give constant cutting action from start to finish — right down to the mandrel. "Best I ever had," reports a long experienced die finisher.

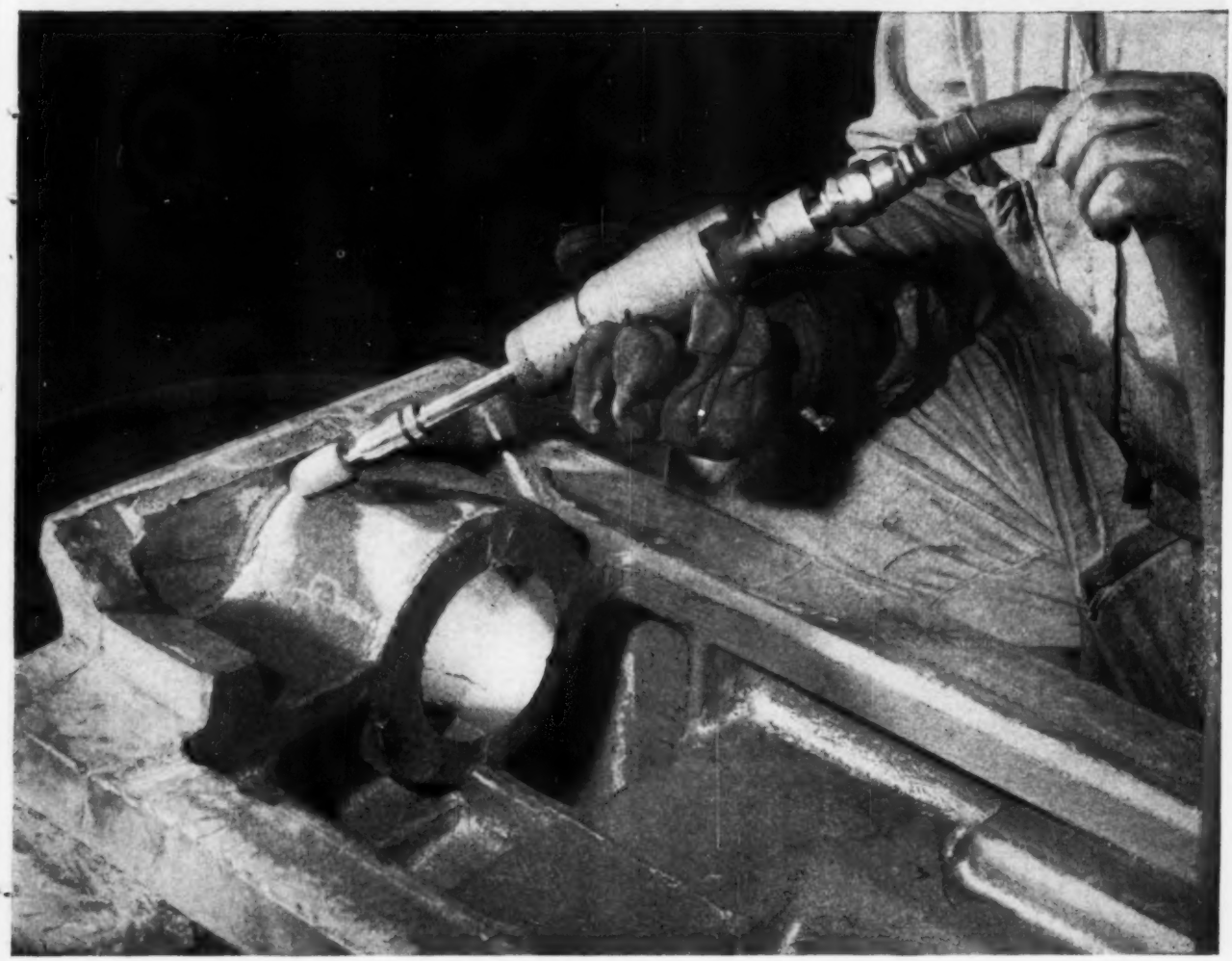
ROUGH GRINDING

For steel castings and weldments, mounted wheels of tough 44 ALUNDUM abrasive with VBE bond, and metal-mounted, are unequalled.

For snagging cast iron, wheels of sharp 32 ALUNDUM abrasive with VBE bond, and metal-mounted, outperform silicon carbide wheels consistently.

Advantages: Norton wheels give you the fastest cutting rate, with a marked increase of stock removed per wheel. "There has never been anything like them for speed and economy in our snagging," says the foreman of a leading foundry.

32 or 44 ALUNDUM Abrasive for your rough grinding



METAL-MOUNTING — *Another Norton Exclusive — You throw nothing away but the mandrel!*

Norton does it again! The mounted wheels are so securely anchored to the mandrel — *you use all of the abrasive!* No waste . . . all work! This radically improved method of locking the abrasive body to the mandrel is used on mounted wheels in most sizes and shapes, 5/16" diameter and larger. Molten metal, injected into the abrasive recess at high pressure, does it — and does it fine!

Every Norton mounted wheel is accurately trued *after mounting* on rust-proof stainless steel mandrels. Developed to increase the time-and-money-saving "Touch of Gold," Norton mounted wheels are stocked in approximately 200 standard shapes and sizes. See your Norton Distributor for prompt deliveries. Or write to NORTON COMPANY, General Offices, Worcester 6, Mass. Plants and distributors around the world.

*Trade-Mark Reg. U. S. Pat. Off. and Foreign Countries

NORTON ABRASIVES

W-1879

Making better products . . . to make your products better

NORTON PRODUCTS Abrasives • Grinding Wheels • Grinding Machines • Refractories • Electrochemicals — **BEHR-MANNING DIVISION** Coated Abrasives • Sharpening Stones • Pressure-Sensitive Tapes

only a GRAY

Cuts going—cuts coming . . . that's "double-cutting" with the GRAY Universal Planer. At Textile Machine Works, Reading, Pennsylvania, this new GRAY is pictured double-cut carbide planing a Tricot Machine Base. Former floor to floor time of 62 hours has been slashed to 12 hours by the enormous productive potential of the new GRAY that cuts both ways.

The G. A. GRAY Co., Cincinnati, Ohio.

heavy-duty planing

The Gray Universal is the world's most powerful planer available for conventional planing. Its rigidity and speed are ideally suited for modern carbide cutting.

CIRCLE 226 READER SERVICE CARD

cuts both ways

double-cutting

The flick of a lever, the touch of a button permits double-cutting. Elimination of the idle stroke insures the world's most efficient flat surface machining. Only simple carbide tools are required.

triple-cutting

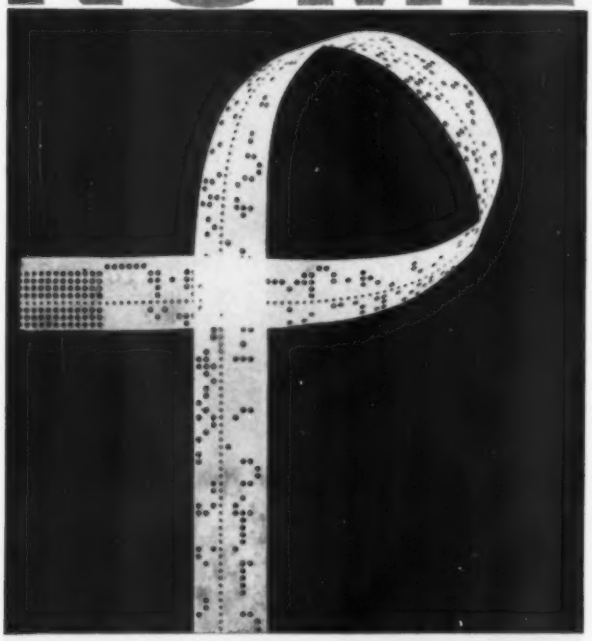
Rough and rough-finish plane at the same time. Rough by double-cut planing and simultaneously rough-finish with a single point tool. Then finish plane without a tool change.

cross planing

Eliminates extra settings by cross planing the occasional keyways, chamfered corners, and other troublesome small cross surfaces that formerly added hours to your set-up time.

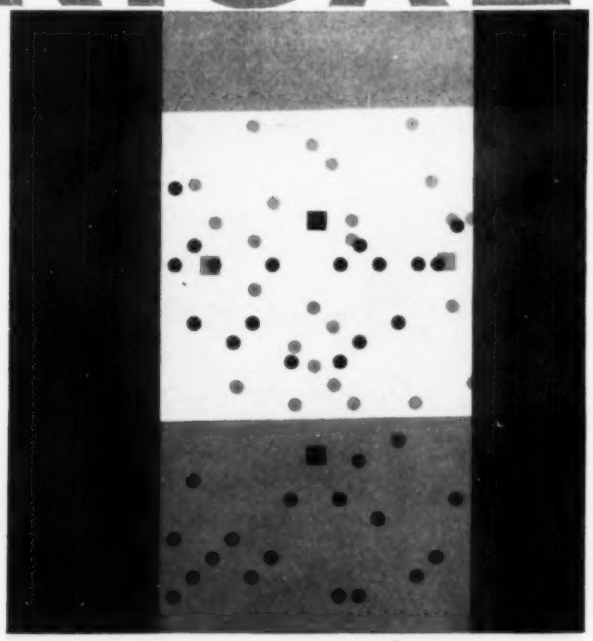
CIRCLE 227 READER SERVICE CARD

NUMERICAL



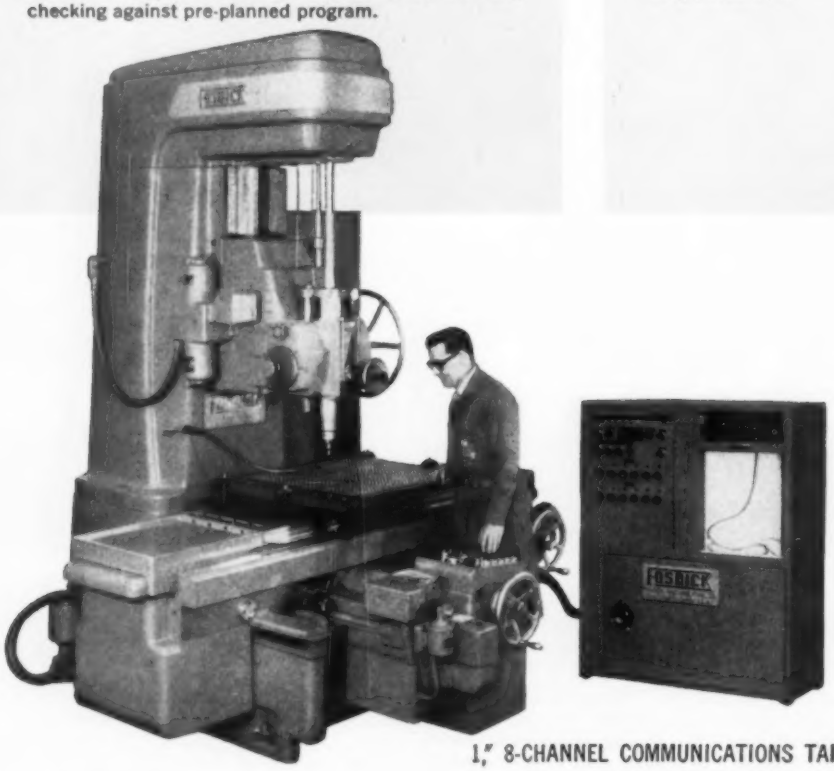
1" 8-CHANNEL COMMUNICATIONS TAPE

Inexpensive, widely used throughout industry, these tapes may be prepared simply on a Flexowriter or similar equipment, usually by the Production Engineering Dept. Provides a typewritten record automatically for easy checking against pre-planned program.



4" MYLAR PLASTIC TAPE

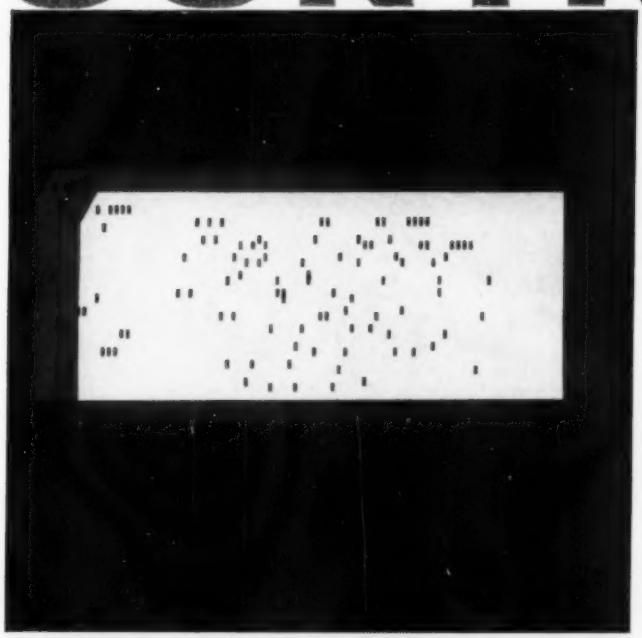
Least expensive of the generally accepted tape systems, particularly suitable for smaller shops machining parts with relatively few holes. Tape can be prepared easily by shop personnel.



1" 8-CHANNEL COMMUNICATIONS TAPE 4" MYLAR PLASTIC TAPE

CONTROL

for Fosmatic JIG BORERS and JIG GRINDERS



PUNCHED CARDS

This system can be integrated with card systems already in use by your company. Each job is programmed in a "deck" of cards; provides great flexibility, since an operation can be added or eliminated simply by making a new card or removing an old one.

Any tape or card reader can be used to control a Fosmatic Jig Borer or Jig Grinder. And because the functions of the standard Fosmatic are actuated electrically, numerical control can be installed in the field—economically!

Speeds and feeds are changed by controlling electro-magnetic clutches through relay contacts. Table and saddle position is determined by a measuring system actuated by direct reading dials. For numerical control, these dials are driven by a fractional hp motor.

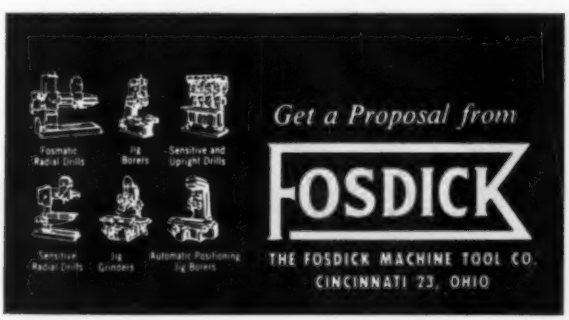
On a Fosmatic, you can program as many functions as you wish. Table X and Y positions (to .0001"), Feeds and Speeds, Spindle start and stop, Spindle feed start and stop, Spindle feed depth, Spindle head height, Automatic tool change. And only Fosmatic gives you a visual numerical check of coordinate location plus operation sequence number.

Example of savings made with Fosmatic numerical control. The illustration (left) shows one half of a mold with 900 cavities, each of which requires nine operations—a total of 8100! Time for the entire job was 100.25 hours, 25% of time consumed previously on a conventional jig borer.

Write or call today for complete information on a numerically controlled jig borer or jig grinder to improve your production method.

PUNCHED CARDS

Buy a Fosmatic today—add Numerical Control tomorrow



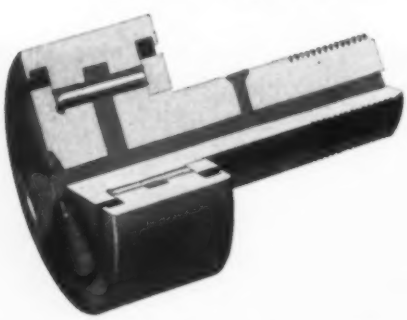
only McGILL® sealed CAMROL® cam followers give you . . .

effective sealing

prelubrication

high radial and shock capacity

in a full range of sizes



Effective sealing of the CAMROL cam follower against moisture, dirt, chips, etc. guarantees longer service life . . . reduces maintenance. This sealed construction retains lubricant and eliminates need for frequent relubrication, so often undesirable in cam action, guide support and track roller applications.

Special seals are built in at stud and flange ends. A black oxide finish on all exposed surfaces offers outside corrosion resistance. The channeled reservoir above the rollers in the outer raceway bore helps store reserve lubricant, sufficient in most cases for lifetime service. Relubrication is possible through convenient oil holes. The new SCF sealed CAMROL cam followers interchange with proven standard CAMROL cam followers. Standard stock with roll diameters up to 4" are available for both stud and shaft mounting.

For maximum bearing life where contamination is a problem, specify sealed CAMROL cam followers. Ask your McGill representative or our engineering department for recommendations.

Write for Catalog No. 52-A

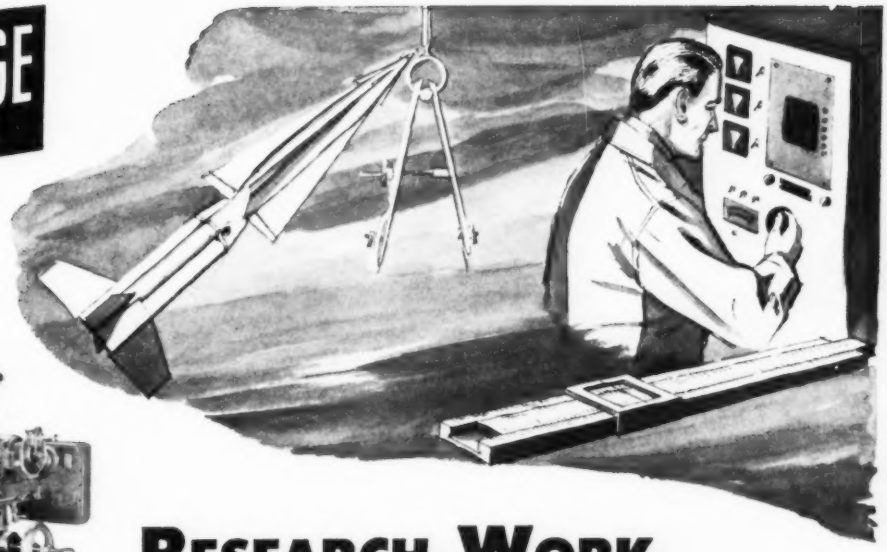
engineered electrical products

McGILL®

precision needle roller bearings

McGILL MANUFACTURING COMPANY, INC., BEARING DIV., 300 NORTH LAFAYETTE ST., VALPARAISO, INDIANA

HARDINGE
ELMIRA, N.Y.

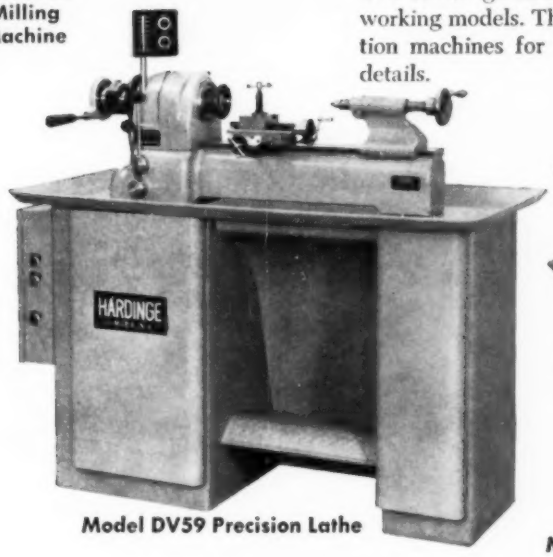


Model UM Universal Milling Machine

RESEARCH WORK *Demands* THE BEST IN MACHINE TOOLS

HARDINGE is the only manufacturer of companion precision machines for milling, straight turning, taper turning, boring, threading and facing with the feature of interchangeable collets, nose fixtures and attachments.

The Hardinge machines illustrated produce precision parts for working models. There are also three Hardinge precision production machines for high speed volume manufacturing – ask for details.



Model DV59 Precision Lathe

Model HLV High Speed Tool Room Lathe

SPECIFICATIONS: *The UM Universal Milling Machine has cutter spindle and spiral dividing head collet capacity of 1-1/16" and a 25 x 6-1/2" swivel table. The DV59 Precision Lathe has 1-1/16" capacity and 9" swing with 17" between centers distance. The HLV Tool Room Lathe has 1-1/16" capacity and 11" swing with 18" between centers distance.*

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

OFFICES IN PRINCIPAL CITIES. Export Office: 269 Lafayette St., New York 12, N. Y.

Ups cutting oil life 12 times with Gulfcut . . . more proof that

GULF MAKES THINGS

Not only the life of cutting oil, but the odor of it when rancid had once been a thorny problem in the Oil Tool Division of Reed Roller Bit Company, Houston, Texas, a major producer of oil well drilling tools.

Here's how they solved both problems with Gulfcut Heavy Duty Soluble Oil. Before they switched to Gulfcut, one department was changing cutting oils on the average of every two weeks. Reason: premature rancidity.

If the oil wasn't changed that often, the objectionable odor would become a personnel problem. Because it was changed that often, at least two man-hours were lost each time a machine was cleaned out. On top of this was the unnecessary cost of replacing oil that frequently.

The previous oil also tended to "clabber up" in the storage drums, especially in cold weather. This made it difficult to prepare the coolant charges. Reed solved all these problems with Gulfcut Heavy Duty Soluble Oil.

They reduced the frequency of cutting oil changes from an average of every 2 weeks to an average of every 6 months. Gulfcut Heavy Duty gave them over 12 times the service life! They had no more trouble with rancidity or solidification in storage.

What's more, in a water-oil ratio of 10-to-1, Gulfcut Heavy Duty Soluble Oil gives Reed's machinists the

Proof in production. These components for the new Reed Y tri-cone drilling bit were precision-bored in a turret drill cooled and lubricated with Gulfcut H.D. Soluble Oil. Boring operation at 550 sfpm. Carbide tool speed: 1,675 rpm. Cutting oil life in this operation: 6 months.

The Gulf man is there. Gulf Representative Jeff Bolling, right, talks to Reed shop superintendent A. R. Whiltsie about the merits of Gulfcut Heavy Duty Soluble Oil—which is used in a total of 21 lathes and drills in the Lugs and Bridges Department. All of the work involves alloy steels.

RUN BETTER!

constant work temperature and lubricity they need—for accurate sizing and desired surface finishes.

How about your operation? Gulfcut Heavy Duty Soluble Oil cuts machining cost through: longer cutting oil life, increased tool life, finer finishes, closer tolerances—and freedom from rancidity, foaming and solidification in storage.

Get the full efficiency-economy story on Gulfcut Heavy Duty Soluble Oil now. See how Gulf makes things run better, operation-wise and cost-wise. Call a Gulf Sales Engineer at your nearest Gulf office. Meanwhile mail coupon for new illustrated bulletin.

GULF

GULF OIL CORPORATION
Dept. DM, Gulf Building
Pittsburgh 30, Pa.

Send me illustrated bulletin on Gulfcut Heavy Duty Soluble Oil.

Name_____

Title_____

Company_____

Address_____

City_____ Zone____ State_____

SP-9363

THIS is No Ordinary Power Hack Saw Blade

This is the *unbreakable* MARVEL High-Speed-Edge Hack Saw Blade—the first bi-metal blade—invented, developed and introduced by MARVEL. This blade is a combination of two materials best suited to the requirements of an efficient hack saw blade . . . a narrow high speed steel cutting edge permanently welded to a tough, non-brittle alloy steel body. Each blade is triple tempered to assure long life and maximum toughness to the cutting edge. Development of this high-speed-edge blade made it possible to cut any kind of material from the free machining steels to the toughest of alloys, fast, accurately and economically. Just one type blade to handle any job — no switching blades to cut different materials. Like all good things, attempted copies of this blade have been numerous, but its performance has been *unequalled* by any of the imitators.

The MARVEL high-speed-edge hack saw blade can be tensioned from 200% to 300% tauter than any ordinary hack saw blade, a definite advantage which permits heavier feed pressures to be used without deflection or fear of breakage.

An extremely rugged cutting tool, this one type blade, the MARVEL High-Speed-Edge Hack Saw Blade, will cut any machineable metal with outstanding economy, accuracy, long life and complete safety—*it is unbreakable.*

Ask for MARVEL Blades by name and you can be sure you're getting the best on the market. Leading Industrial Distributors have them in stock.

B-1120

Write for latest cutting tool Bulletin and the name of your nearest MARVEL Distributor

MARVEL Metal Cutting SAWS
Better Machines—Better Blades

ARMSTRONG-BLUM MFG. CO. 5700 W. Bloomingdale Ave., CHICAGO 39, U.S.A.

WHAT THE CLEVELAND DIALMATIC DOES FOR VEE-ARC... IT CAN DO FOR YOU!

VEE-ARC CORPORATION
WESTBORO, MASSACHUSETTS
V A C
PRECISION MACHINE PRODUCTS

The Cleveland Automatic Machine Company
4932 Beech Street
Cincinnati 12, Ohio

Attention: Mr. John Prohaska.

Gentlemen:

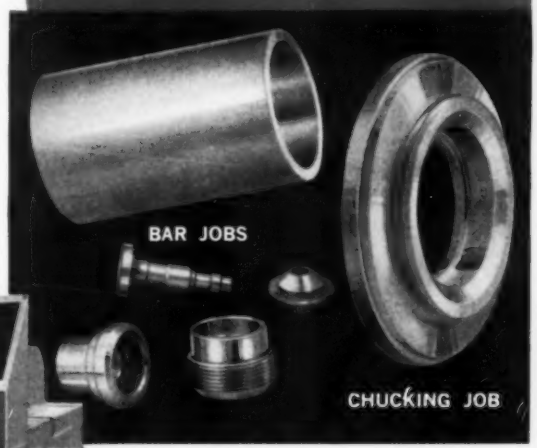
Our experience with our Cleveland 3" AB Automatic has been most gratifying. Its great versatility and accuracy as a chucker as well as a bar machine, coupled with its ease of set-up, due primarily to the use of universal cams and infinitely variable electronic feeds, and its low cost of maintenance has contributed greatly toward keeping our prices competitive and our quality high.

Because of its ease of set-up, we have used this machine to advantage on short runs of as few as 200 pieces as well as long runs of several thousand pieces.

Needless to say, we are extremely happy with our choice.

Very truly yours,
VEE-ARC CORPORATION
Aram Kalenian,
President.

Aram Kalenian, writer of the letter reproduced above, and president of Vee-Arc Corp., is shown with Ralph Rastad, superintendent, and Paul Daoust, operator, examining a chucking job run on their 3" Model AB Cleveland Dialmatic.



The parts shown (some are blanked out, others are machined complete) are typical of those produced on the Model AB 3" Cleveland Single Spindle Automatic at the Vee-Arc Corp. Diameters of these parts range from 5/8" to 4 1/4", and materials include aluminum, type 303 stainless, and tough, cold hobbing steel

By making use of the Cleveland's chucking attachment, which is quickly substituted for the bar stock feed assembly, the part shown at right is machined from blanks of 4 1/4" round aluminum bar stock in 98 seconds cycle time.

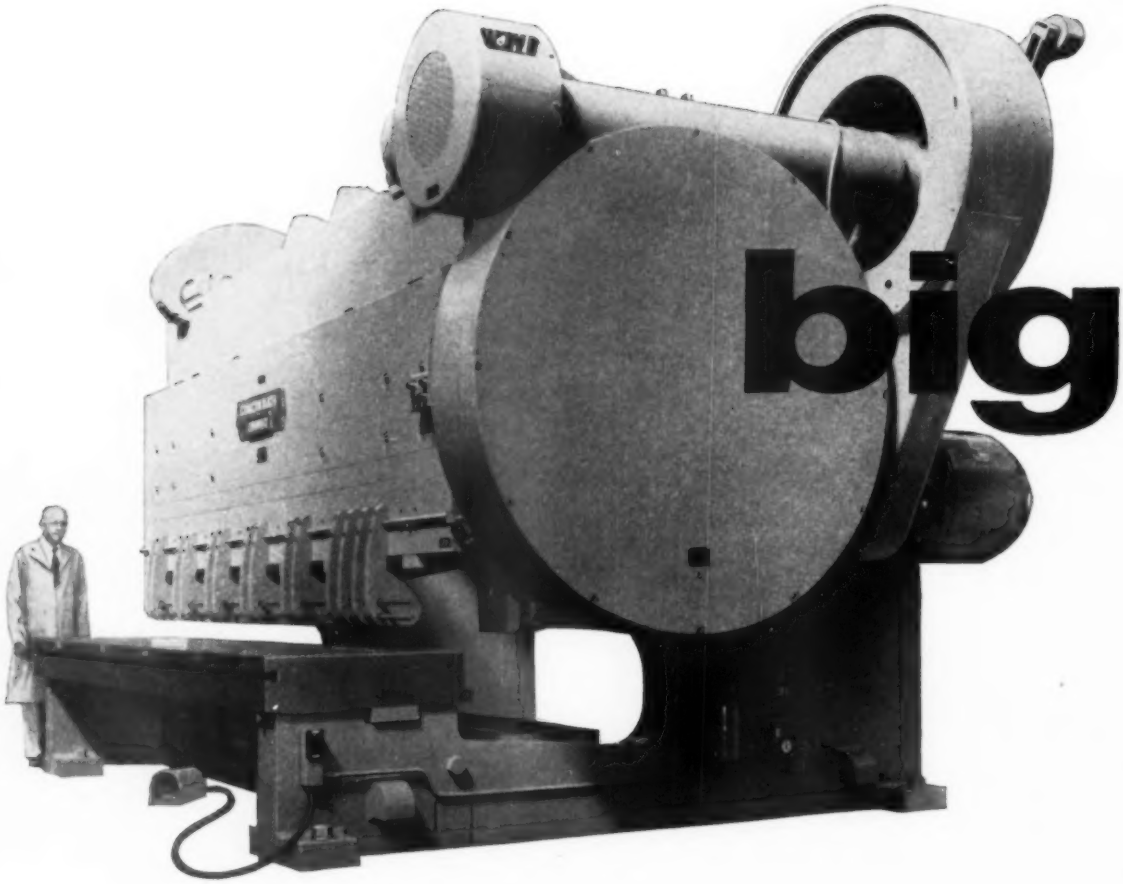
What the Cleveland Dialmatic does for Vee-Arc, it can do for *you!* Choose Clevelands to increase the production efficiency in your plant.

THE CLEVELAND AUTOMATIC MACHINE COMPANY

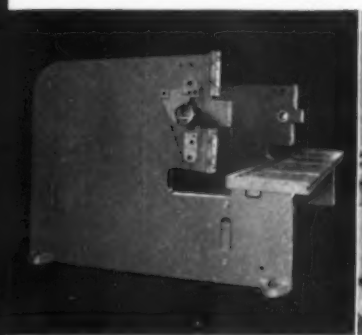
4928 Beech Street
Cincinnati 12, Ohio

SALES OFFICES: CHICAGO
CLEVELAND • DETROIT
HARTFOKD • S. ORANGE

Manufacturers of a Complete Line of Single Spindle Automatic Screw Machines and High Pressure Hydraulic Die Casting Machines

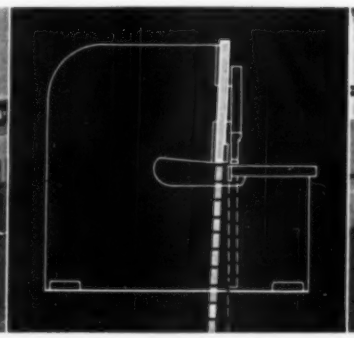


Typical Cincinnati Shears: **big** series 15012, capacity 1½", 12'; **small** series 1004, capacity 5/16", 4'; **in between** series 1810, capacity ¼", 10'.



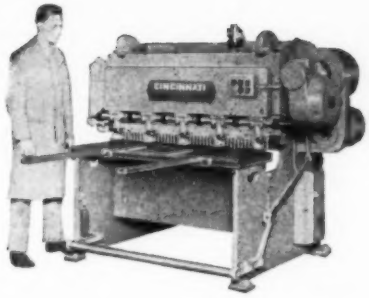
All steel, interlocked construction—no welds used as load supports

Hydraulic holddowns exert tons of pressure, insure accuracy

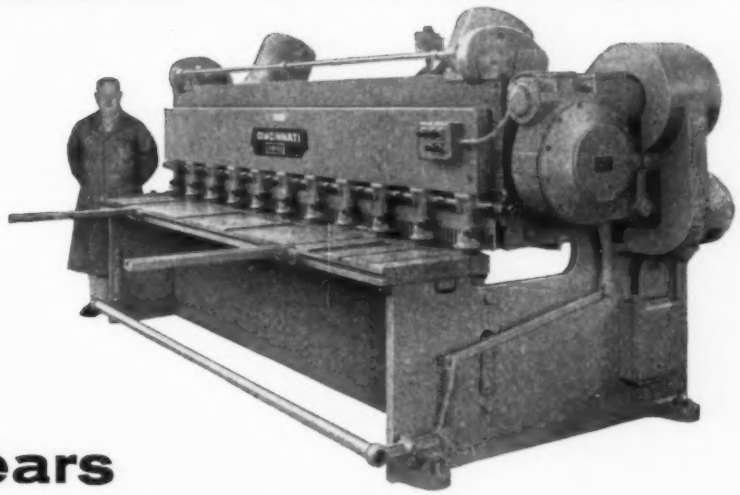


Non-float inclined ram maintains extremely accurate knife clearance

Front controlled power back gag is standard, accurate, convenient



small or in between



Cincinnati Shears give you every advantage

Simple operation, micrometer accuracy, cost-cutting speed, all-steel construction, and versatility—these are the advantages which make Cincinnati Shears earn their way in your plant.

And, whether you're shearing steel or plastics, nonferrous metals or asbestos, wire mesh, clad metals, or even radioactive material, the Cincinnati Shear line gives you a range of choices to fit your own requirements. Cincinnati Shears are in service cutting all of these materials.

Cincinnati ruggedness enables you to use one knife clearance for all thicknesses up to machine capacity.

Power operated back gages which are standard equipment, reduce non-productive time. Hydraulic holddowns provide tons of pressure, insure accuracy. The inclined ram permits the economy of four-edge knives, keeps work from binding between back gage and lower knife.

Since gap frames are standard, you can do notching, slitting or shearing work longer than the machine on any Cincinnati Shear to the limit of its gap.

Be sure to get the full Cincinnati story before you buy your next shear. Write Dept. A for Catalog S-7R.

Shapers / Shears / Press Brakes

THE CINCINNATI SHAPER CO.

Cincinnati 11, Ohio, U.S.A.

It's NEW...
Another AO Respiratory "First!"
the "RED DEVIL" Filter

The Revolutionary R-90 "Red Devil" Variable Density Filter for the AO R-2090 Respirator

Bureau of Mines Approval #2172 for protection against all dusts not significantly more toxic than lead, pneumoconiosis-producing mists and chromic acid mist.

The R-90 filter represents the greatest technical advance in respirators since American Optical introduced "impregnated (electrostatic) felt" in our R-25 filters. These widely copied filters must now give way to continuing AO research and progress. The R-90 Red Devil is available only from AO — provides amazingly high filtering efficiency, plus very low breathing resistance . . . and unusually long service life because of a built-in prefilter. Act TODAY — equip personnel with the AO R-2090. Avoid attempted imitations — insist on AO "Red Devil" filters and respirator! Filters available in package of 5 or package of 50.

Quick Facts

- Fibrous filter. Interlocked microfine synthetic fibers on which ultrafine asbestos fibers are dispersed.
- New "Air Floatation" process forms the medium.
- Concentration gradient of ultrafine asbestos fibers insure higher filtering efficiency, lower breathing resistance and longer service life.
- All fibers bonded together by special fusion process.
- Precision AO built-in red prefilter for positive identification and thermally bonded to main filter for extra long service life.
- Compact and lightweight — 3" dia., 1/5" thick. 1/300 of an ounce.

WRITE FOR ADDITIONAL INFORMATION

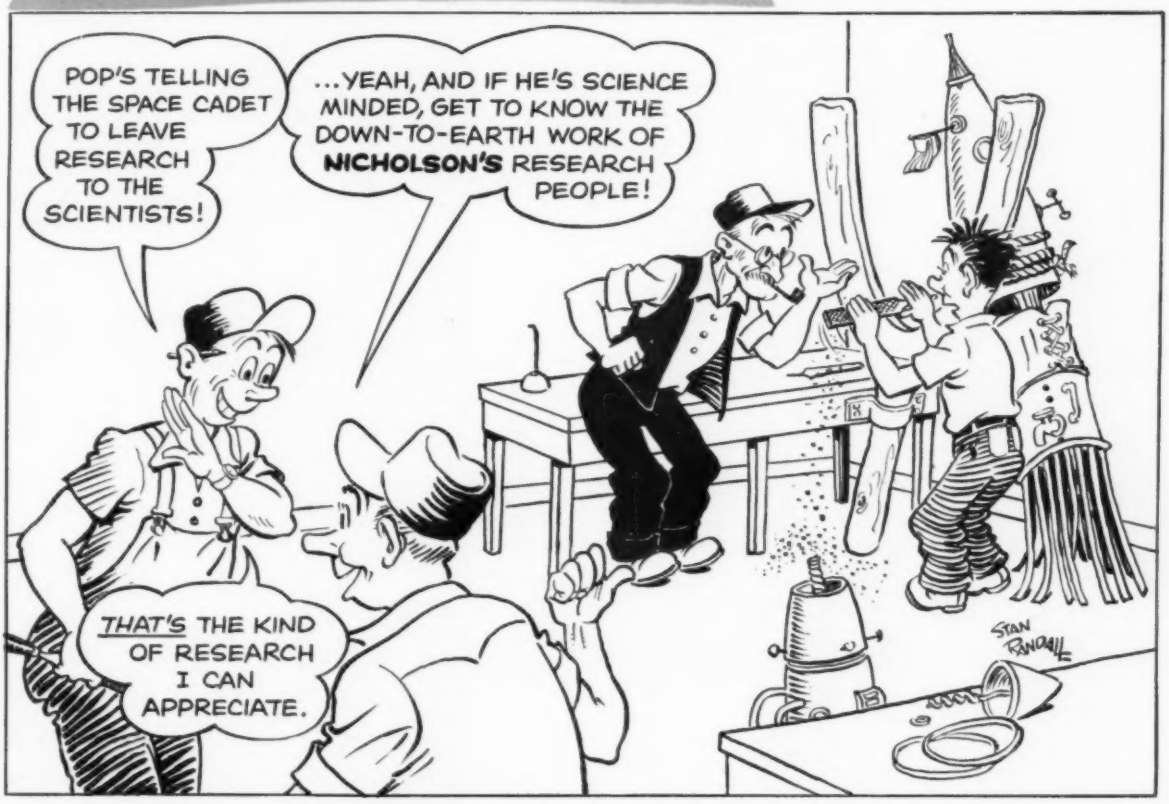
American Optical COMPANY
SAFETY PRODUCTS DIVISION

1833-1958 • 125 LEADERSHIP YEARS

Always insist on AO Trademarked Safety Products.

SOUTHBRIDGE, MASS.
Safety Service Centers in Principal Cities

POP'S school of Filing


POP'S TELLING THE SPACE CADET TO LEAVE RESEARCH TO THE SCIENTISTS!
...YEAH, AND IF HE'S SCIENCE MINDED, GET TO KNOW THE DOWN-TO-EARTH WORK OF NICHOLSON'S RESEARCH PEOPLE!
THAT'S THE KIND OF RESEARCH I CAN APPRECIATE.
STAN RANDALL

NICHOLSON RESEARCH SEEKS WAYS TO HELP YOU

Research has always been a part of our business—an important part.

From the time the first Nicholson file was made, we have had a research department which has constantly looked for and found ways to improve file design and manufacturing methods.

Today research is one of the most important parts of our engineering department. Our search for still further improvements goes on. Recently, this work led to the "Magicut," an All-Purpose Machinist's file (illustrated above) with a new type of tooth construction. This new file now cuts filing costs wherever many companies file metal.

In addition to new products, there's another service for you in our research department. When you have a filing problem, our research staff will gladly work out an answer. We have the facilities and the technical people to find the answer. If you'd like help with a filing problem, let your Nicholson or Black Diamond distributor know. We'll get you the answer quickly.

✳ **Industrial Distributors provide the finest goods and services in the least possible time. Our files are sold exclusively through them.**

NICHOLSON U.S.A. **NICHOLSON FILE COMPANY, PROVIDENCE 1, RHODE ISLAND** BLACK DIAMOND U.S.A.

(In Canada: Nicholson File Company of Canada Ltd., Port Hope, Ontario)

NICHOLSON and BLACK DIAMOND FILES

A FILE FOR EVERY PURPOSE

CTRONIC NTROL STEMS

LEADERS IN NUMERICAL CONTROL

S-C
STROMBERG-CARLSON

Electronic Control Systems, "Leaders in Numerical Control," is today producing DIGIMATIC machine tool controls ready for immediate installation in any factory or shop throughout the country.

To give nation-wide strength to this program, ECS has now become an integral part of Stromberg-Carlson. This new combination assures our customers the finest products and the best in customer service.

ELECTRONIC CONTROL SYSTEMS
Division of
STROMBERG-CARLSON
A DIVISION OF GENERAL DYNAMICS CORPORATION
2231 S. Barrington Avenue · Los Angeles 64, California

*Stainless Steel spinning information:

*Before you take a spin—check the oil

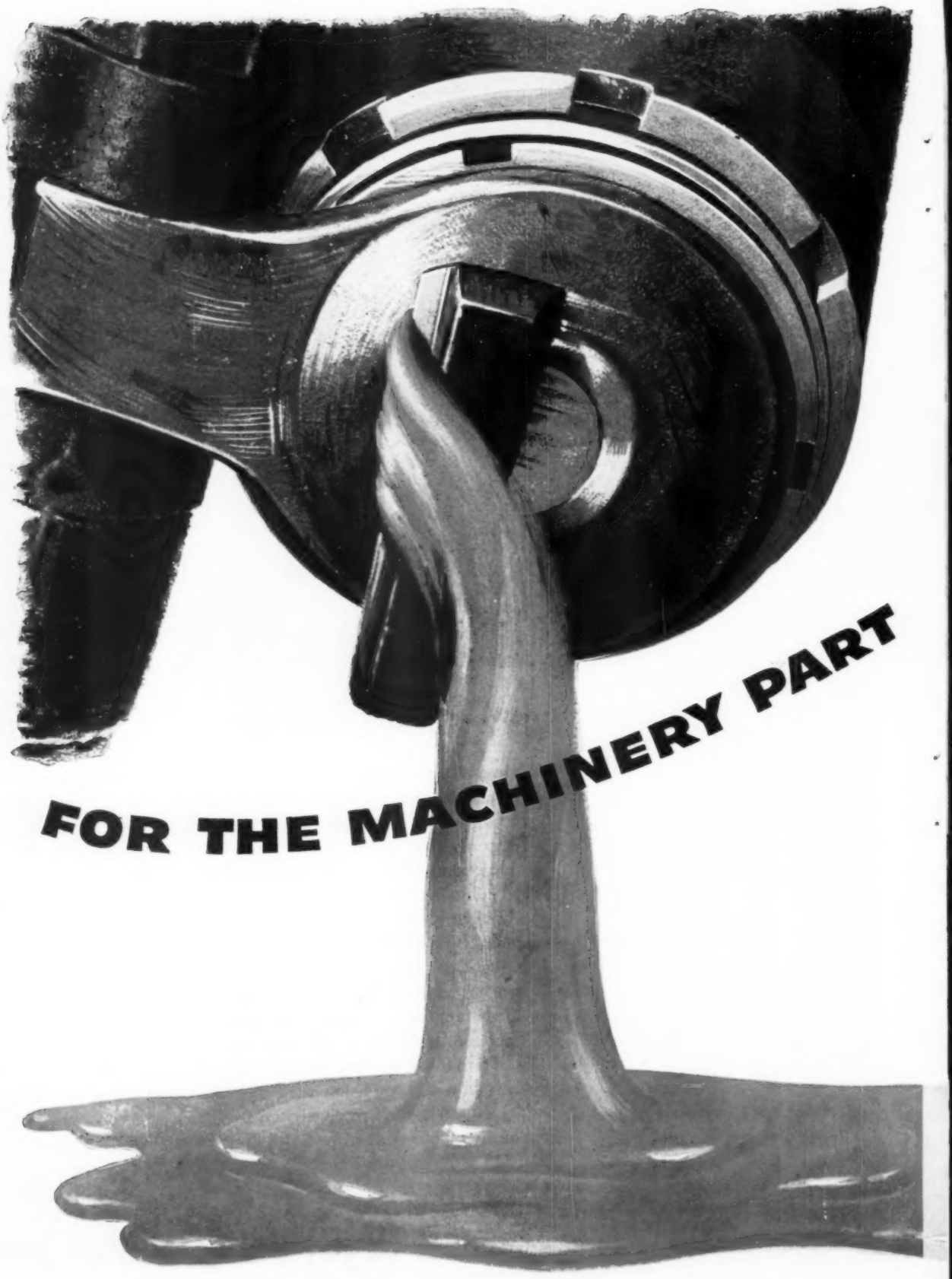
Stainless Steels lend themselves readily to cold spinning. When you spin Stainless Steel, be especially generous with the lubricant. Use lubricants with sufficient body to withstand the high pressures and temperatures that may develop. Because of Stainless Steel's superior toughness, greater pressure is required than that used for carbon steel. A good spinning tool is made of hardened alloy steel. It should have a large bearing surface to distribute the pressure as widely as possible.

Spinning Stainless Steel will give you accurate and uniform wall thickness in one operation not readily obtainable in drawing. Certain shapes can be spun more economically than drawn, which may require several operations and heat treatment. Remember, too, that certain types of steel are more adaptable to spinning than drawing.

You'll find that Stainless Steel isn't difficult to spin, it's just different. You can do a top-notch job with ease when you follow our 130-page manual. If you haven't received your free copy, write on your company letterhead for our "Stainless Steel Fabrication Book," United States Steel, 525 William Penn Place, Pittsburgh 30, Pa. *USS is a registered trademark*

United States Steel Corporation – Pittsburgh
American Steel & Wire – Cleveland
National Tube – Pittsburgh
Columbia-Geneva Steel – San Francisco
Tennessee Coal & Iron – Fairfield, Alabama
United States Steel Supply – Steel Service Centers
United States Steel Export Company

USS United States Steel


FOR THE MACHINERY PART

THAT TAKES THE BEATING

A cut-off knife made of HAYNES STELLITE alloy No. 19 slices through molten glass at 2200 deg. F. Despite the intense heat of the glass being molded into tumblers, and the severe erosive action of the glass on metal, the cut-off knife maintains a 0.015-in. clearance between itself and the mold ring . . . *far longer than any other material ever used.*

Are you looking for a tough metal part to improve your machinery? It will pay you to look into HAYNES alloys. There are more than 15 from which to choose, including HAYNES STELLITE cobalt-base alloys, HAYNES iron-base alloys, HAYSTELLITE cast tungsten carbide, and HASTELLOY nickel-base alloys. They are available as castings, forgings, completely fabricated parts, or as sheet and bar stock. Parts can be furnished machined or ground to specified size and finish.

Our engineers will help you pick the right HAYNES alloy to resist many conditions of wear, heat, or corrosion.

HAYNES Alloys *will do the job!*

HAYNES ALLOYS

HAYNES STELLITE COMPANY

Division of Union Carbide Corporation

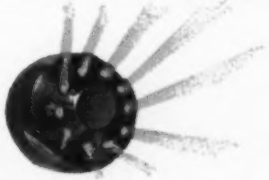
Kokomo, Indiana

UNION CARBIDE

The terms "Haynes," "Haynes Stellite," "Hastelloy," "Haystellite" and "Union Carbide" are registered trade-marks of Union Carbide Corporation.

TYPICAL "HAYNES" ALLOY MACHINERY PARTS

Tough, long-lasting metal-cutting saws over 20 inches in diameter, made of HAYNES STELLITE alloy sheet, slice the tops off copper ingots.



Steam atomizer fuel burner nozzles of HASTELLOY alloy C resist corrosive agents and erosion for months, retaining essential contours.

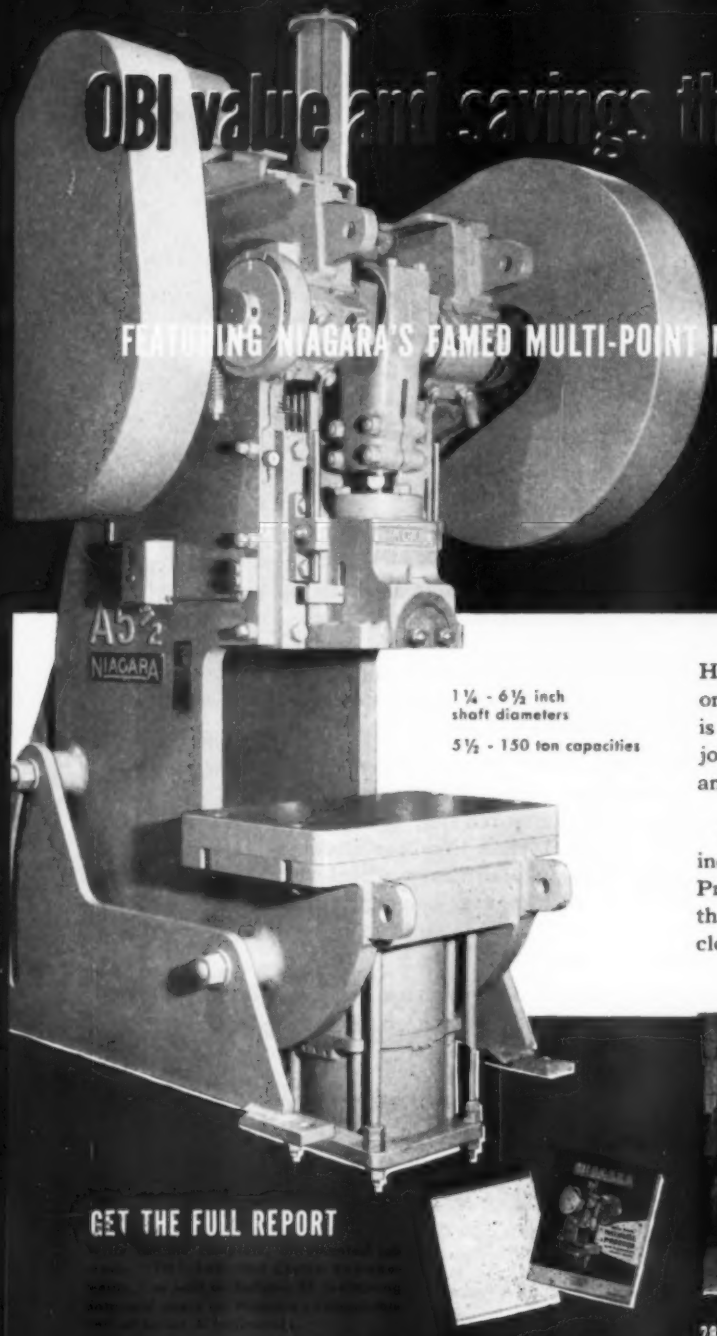
High-temperature strength and corrosion resistance of diesel combustion chambers made of HASTELLOY alloy C make them "good for life of the engines."

TON FOR TON . . . DOLLAR FOR DOLLAR

OBI value and savings that can't be matched!

FEATURING NIAGARA'S FAMED MULTI-POINT MECHANICAL SLEEVE CLUTCH

Picks up load on 14 engaging jaws. Applies driving force concentrically without keys or pins. Assures instant engagement and maximum productive strokes per minute. Needs no air nor electricity. Practically no maintenance. Greater safety: Simplified controls, fewer parts to wear out. *Yes, if permits, inching, too.*



1¼ - 6½ inch shaft diameters

5½ - 150 ton capacities

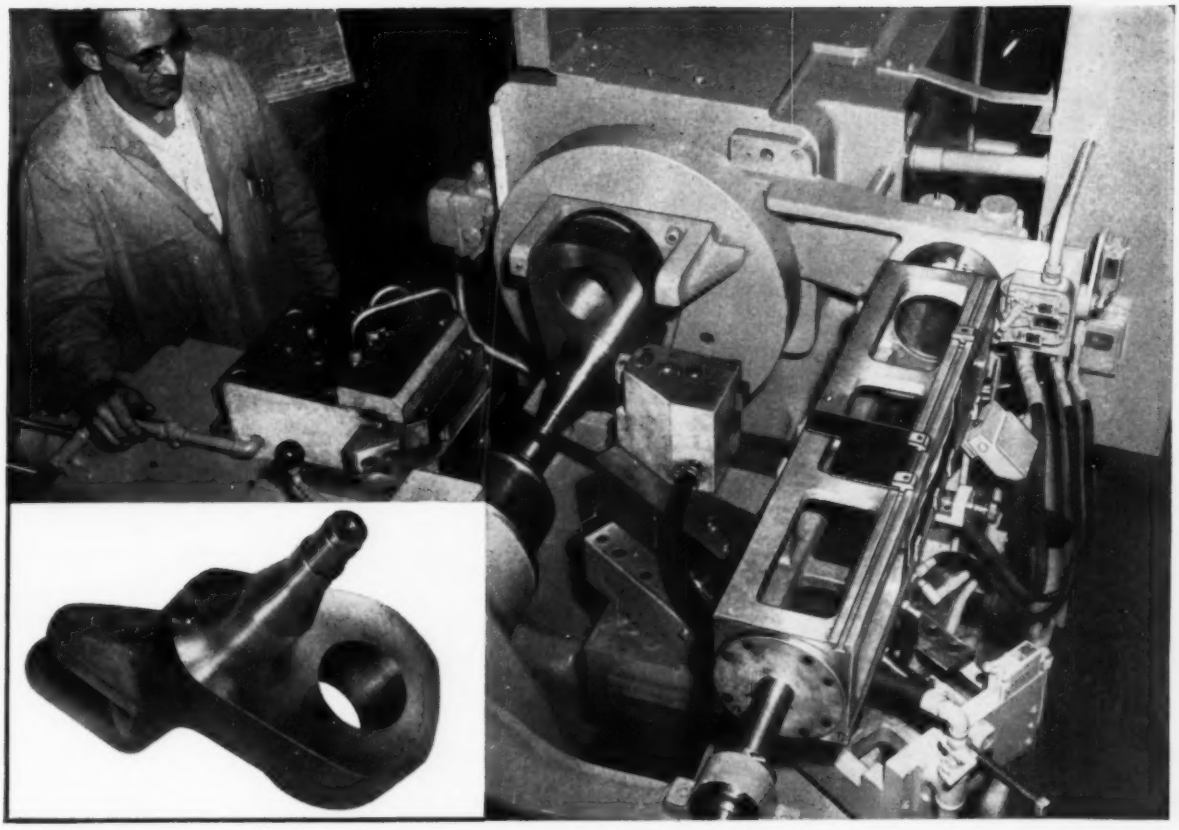
Here's a workhorse that's known for setting the pace on the most demanding jobs... jobs where the clutch is engaged and disengaged at every press stroke... jobs that call for operation three shifts a day, day in and day out.

Built and *backed* by a company which produces industry's greatest variety of inclinables*, Series A Presses have amassed an unusual success record in thousands of applications. To be specific, let's take a close look at a Series A user:

28 OBI'S SINGLE STROKED 707,140,000 TIMES
WITHOUT ONE CENT SPENT ON CLUTCH ENGAGING SURFACES

GET THE FULL REPORT

NIAGARA SERIES A OBI PRESSES



Whips problem part with right equipment

Handles tough, interrupted cut and contour machining easily with Gisholt No. 24 Automatic with JETracer

Here's how this producer is holding floor-to-floor time on military tank idler arm forgings—18″ long with 5½″ major radius—to just 21.1 minutes.

The job is done with the powerful Gisholt No. 24 Automatic Production Lathe, using a JETracer on the rear independent slide, plus a 2-speed motor for correct machining speeds when facing and turning.

With the part held between centers, a special face plate fixture locates the work and drives against the large O.D. radius. All cuts are made separately; each slide performs a rough and finish pass. The front tool slide faces at 60 r.p.m. and .015″ feed (306 f.p.m.) and has automatic tool relief. Two tools divide the length of cut to shorten machining time. A special step-over cam arrangement repositions the front carriage and its tools for the finish pass.

The JETracer uses a 4-position indexing cam roll (permitting up to 4 automatic passes if needed), and controls the rear slide which turns all diameters on the idler arm at 180 r.p.m. and .015″ feed (259 f.p.m.).

Whatever your production picture on large parts—long steady runs or small repeat lots—you'll find proven ways to cut costs with the Gisholt MASTERLINE No. 24 Automatic Production Lathe. One operator handles 2 or more of these powerful machines, or does other jobs during machining time, because all machine functions are automatically controlled. Setups and change-overs are fast and simple.

For complete details on the No. 24 and other Gisholt machines, call your Gisholt Representative today. He has the facts, and his wide experience may point the way to more profitable production in your plant.

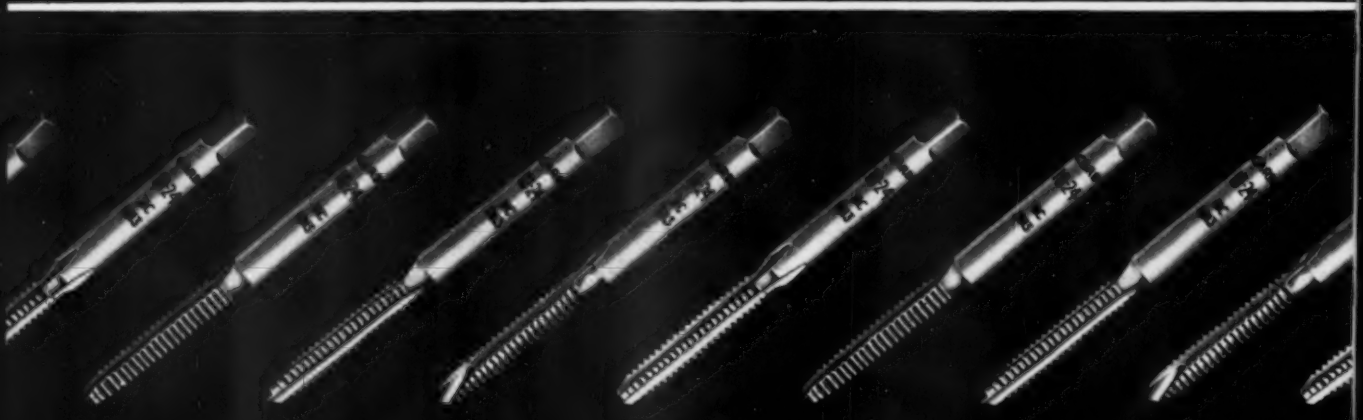
MASTERLINE GISHOLT SINCE 1887 GISHOLT

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin, U.S.A.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • PACKAGING MACHINES • MOLDED FIBERGLAS PLASTICS

As these torpedoes are uniform



. . . So Card machine screw taps are uniform, too

Your production's consistent ...because Card taps are uniform

Your first step in consistent production performance is the cutting tool itself. Because Card machine screw taps are identical they keep production up to par — and predictable. Shopmen know about the uniformity of Card taps. Card gages are like that, too. S. W. CARD DIVISION, Mansfield, Mass. Card Warehouses: Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco.

The CARD Quality

CARD

DIVISION OF UNION TWIST DRILL COMPANY

— Serving you through the best distributors from Coast to Coast

CIRCLE 246 READER SERVICE CARD

If you use drills as much as paper mills use pulp...

This brand cuts down your drill usage, production time and costs!

The more you use drills the more you need Union

Union's top quality drills reduce your production costs to the lowest per hole on every drilling job. Union also manufactures milling cutters, gear cutters, end mills, reamers, hobs, carbide tools and inserted blade cutters. Available nationally through Union Distributors and stocked in Union warehouses in Atlanta, Chicago, Detroit, Fort Worth, Los Angeles, New York City and San Francisco.

UTD

UNION

TWIST DRILL COMPANY, Athol, Massachusetts

S.W. CARD DIVISION, Mansfield, Mass.; BUTTERFIELD DIVISION, Derby Line, Vt.

See Your UNION DISTRIBUTOR for cutting tools that will save you time and money

CIRCLE 247 READER SERVICE CARD

Another MINSTER First in Press Design Operating in Production Lines Since 1953 Has Proved That You *Can* Get

More Single Stroke Operations

The exclusive "hidden value" in the Minster MS2 press is Minster's patented Intermediate Shaft Combination Air Friction Clutch and Brake Drive arrangement.

This drive arrangement makes it possible to get a higher single stroke efficiency, based upon rated continuous press speed, and the widest speed selection ever available on large double geared straight side presses.

Here's what this exclusive Minster feature can mean to you

- More production on manually fed or automated presses.
- Faster starting and stopping . . . more single stroke operations per minute.
- Less flywheel energy loss . . . lower power consumption.
- Reduced clutch wear . . . less maintenance and adjustment.
- You may select either the faster speeds of a conventional single geared machine or the slower speeds of a double geared press. Two-speed drive (optional) allows selection of a speed to fit different type operations.

How it works:

MS2 presses are double geared and have twin drive gears on the crankshaft. Minster's patented Combination Air Friction Clutch and Brake unit is mounted on a slower turning *intermediate shaft* instead of within the flywheel on the high speed drive shaft.

This means lower contact speed of clutch friction surfaces, resulting in very little heat on linings and less wear.

Flywheel can be run at maximum RPM for maximum energy without limiting speed of operations.

Additional Minster MS2 Press Features

Minster Recirculating Oil Lubrication system provides continuous oil film on all bearing surfaces . . . allows closer bearing and gib clearances for reduced lash and better slide guiding.

All air, lubrication and electrical systems are complete, enclosed within the press frame line, yet easily accessible. Electrical circuits and pneumatic systems for manual or automated production. Controls mounted within cabinet type uprights.

Massive, box type, four-piece tie rod frame for rigidity.

Precise slide to bed parallelism. Slide fully guided within gibs before midstroke is reached.

Outboard drive sheave for easy belt changing.

All wear surfaces bronze-lined, precision fitted and replaceable.

Per Minute

MINSTER®
MS2 Presses

150 TO 500 TON CAPACITIES

in five widths R to L in each capacity—two F to B dimensions in each capacity.

Dimensions meet J.I.C. Standards

THE MINSTER MACHINE COMPANY
MINSTER, OHIO

What is the BIGGEST

Here's LeBlond rigidity in action at Alliance Tool & Die Corp., Rochester, N. Y. The part is a 6500 lb. molybdenum steel compressor wheel. 32 micro finish and ± .001", minus .000" critical tolerance on bore, recess and hub!

workpiece your lathes can turn?

Probably your lathes will swing a 32″ piece. Or 40″. But what happens when that occasional 50″ or 60″ job comes along? Chances are you have to say, "We can't handle it. After all, how can you justify a big swing lathe, just for a few big jobs a year?"

Today there *is* a practical and economical solution to this odd-size work problem. LeBlond Sliding Bed Gap Lathes.

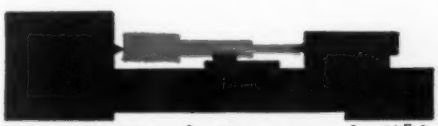
Our 32″/60″ Heavy Duty will accommodate work up to 60″ diameter! Basically this is a 32″ lathe. But it has an extendible bed (an upper bed that slides on a lower bed). Slide it to the right, and a gap opens. Now, you have a full 60″ swing! Also, for extra long work, there is 50% greater center distance. And the rest of the time you have a regular 32″ heavy duty lathe for a wide variety of work.

3 lathes in one—at the cost of a lathe and a half!

Here's an example of how this extra capacity pays off. Alliance Tool and Die Corp., Rochester, N. Y. are specialists in unusual machining problems, like precision molds—and the bulky compressor wheel, shown here. How did they turn it before? They didn't. The part was too big. Now, with their 32″/60″ LeBlond (recommended by Macaulay Machinery Co., Rochester, N. Y.,) they take jobs like this right in stride. Actually, this particular order was made possible by this lathe.

If you do job shop work, you can consider this lathe a business-getter. If you're doing your own maintenance, it gives you the capacity to do virtually all your own turning work. LeBlond Sliding Bed Gap Lathes are available in 4 sizes—16″/38″, 25″/50″ and 32″/60″ (shown) Heavy Duties and the 17″/28″ Regal. You're sure of getting the right lathe for your job when you buy LeBlond. There are 76 lathe models to choose from. Call your LeBlond Distributor or write.

Here's how the LeBlond Sliding Bed Gap Lathe gives you extra capacity for extra large work:



BED GAP CLOSED—*functions as a regular 32″ lathe.*

BED GAP OPEN—*full 60″ swing.*

BED FULLY EXTENDED—*50% greater center distance.*

. . . cut with confidence

THE R. K. LEBLOND MACHINE TOOL COMPANY
Cincinnati 8, Ohio

LeBLOND *of Cincinnati*

World's Largest Builder of a Complete Line of Lathes for More than 71 Years

CIRCLE 251 READER SERVICE CARD

Fine tools that encourage Good Work

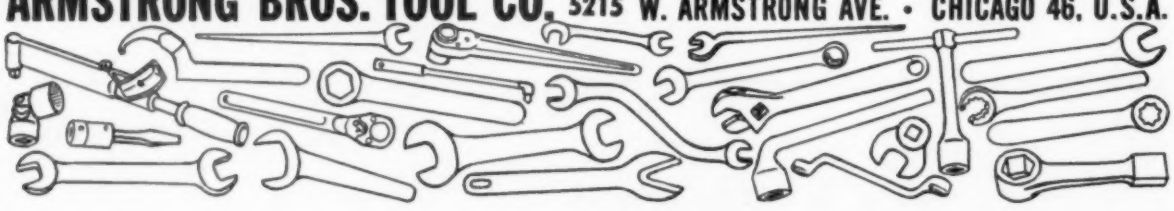
ARMSTRONG WRENCHES

An ARMSTRONG Wrench feels right—is balanced. It goes over nuts or screw heads easily, grips firmly without sloppiness, won't round corners—because openings are carefully machined to correct sizes. It's safe, strong beyond need without clumsy bulk—because of superior design and selected steels, heat treated to proper degree of hardness and tensile strength. It's quality finished, ARMALOY (alloy steel) Wrenches in chrome plate with heads buffed; HI-TEN (carbon steel) Wrenches in baked-on gray enamel with heads ground bright . . . all plainly marked for size. All are uniformly excellent tools manufactured under strict quality control, by modern methods, with modern equipment in a modern tool plant . . . 1537 different industrial sizes and types—single wrenches, or sets in metal cases, boxes or rolls . . . each a quality tool. Armstrong Wrenches are "Fine tools that encourage good work."

INDUSTRIAL DISTRIBUTORS · SERVING INDUSTRY ECONOMICALLY · THE RIGHT HAND OF PRODUCTION

If you don't know your local ARMSTRONG Distributor, we will send you the names of those in your area.

ARMSTRONG BROS. TOOL CO. 5215 W. ARMSTRONG AVE. • CHICAGO 46, U.S.A.



Economy-priced Royal Drills are multi-purpose machines. Built to handle light drilling on a production basis, they are ideal for utility operations as well. And, because they are CINCINNATI-quality *metalworking* drills, they maintain accuracy longer. That's why, in the long run, *they cost less than the lowest price drill.*

CINCINNATI Royal Drills are built in 16″ and 18″ sizes in bench, floor and multiple spindle models. This $128.00 bench model includes vee belt, belt guard, manual control (single phase) with overload protection, motor mount.

Call in your CL&T Dealer Or, write us direct.

Among CINCINNATI quality features are:

- Complete electrical controls built into the head.
- Convenient, positive depth stop.
- Tilting motor bracket for rapid speed changing.
- 6-spline spindle mounted in 4 precision bearings.
- 5 spindle speeds.
- ½″ drilling capacity in C.I.
- Spacious tables and bases.

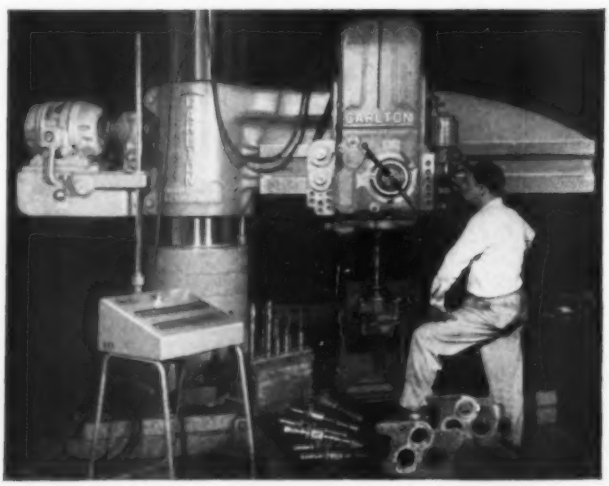
Improved Machining Through Research

CINCINNATI LATHE AND TOOL CO.

3207 Disney Street • Cincinnati 9, Ohio

"TRAY-TOP" Lathes / "CINCINNATI" Drilling Machines / "SPIROPOINT" Drill Sharpeners

"We like the quality and consistency

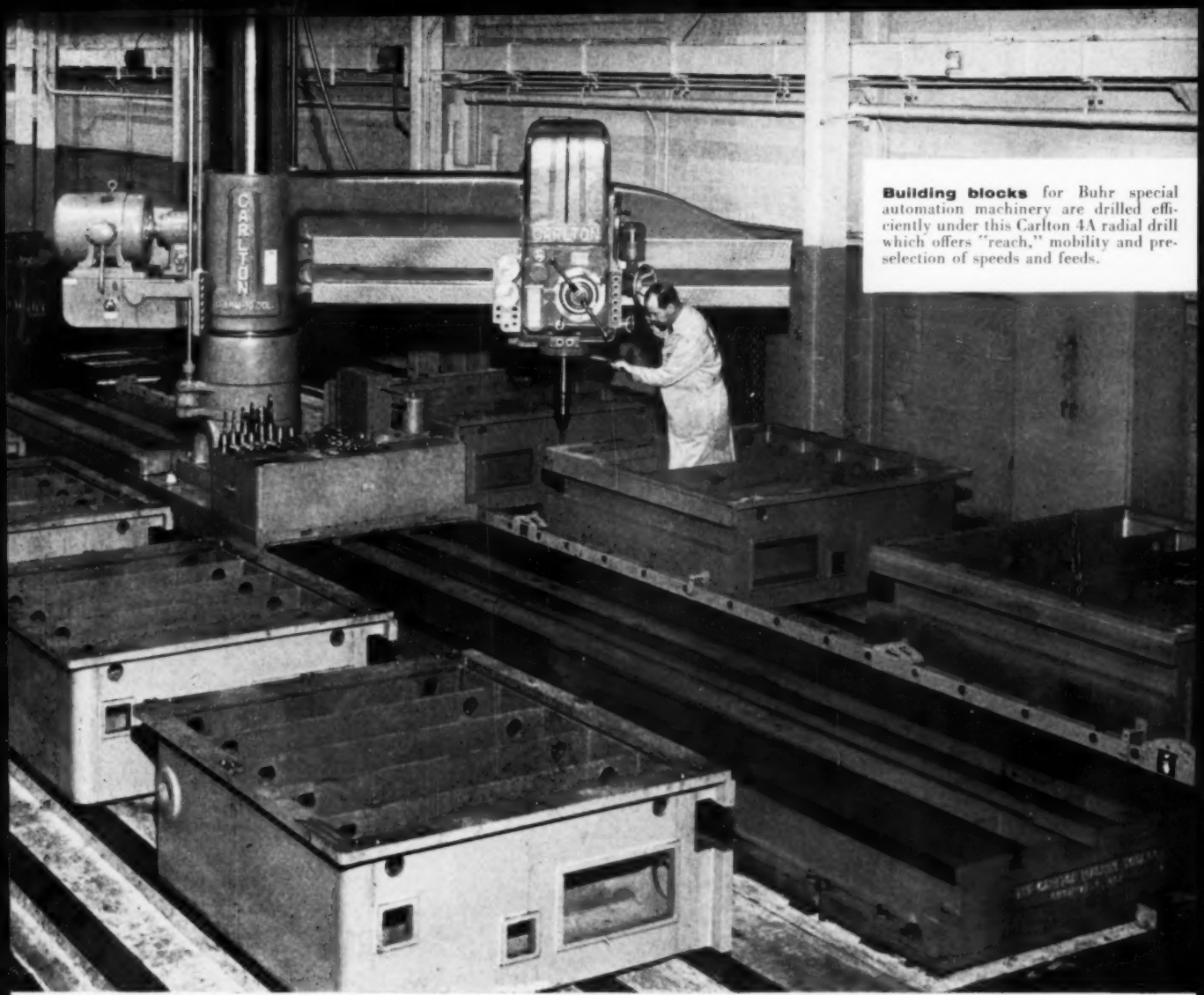


"As a manufacturer of special multiple-operation machines, we know how important it is to customers to be able to depend on consistent high quality," says Vern Doneth, plant superintendent, Buhr Machine Tool Co., Ann Arbor. "That's why we're so well pleased with the high quality, day-in-day-out performance of our Carlton radial drill.

"When we bought our Carlton, we had in mind the wide choice of size, speed-feed controls and types

Programmer-pre-selector speed-feed control for Carlton radial drills cuts drilling costs as much as 19%, as determined by extensive 3-month study. Complete report contained in bulletin 110, free upon request.

CIRCLE 384 READER SERVICE CARD



Building blocks for Buhr special automation machinery are drilled efficiently under this Carlton 4A radial drill which offers "reach," mobility and preselection of speeds and feeds.

we get from Carlton Radial Drills"

of bases. This enabled us to choose exactly the right combination for production drilling and boring of standard components for Buhr 'building block' machines.

"We selected the Carlton 4A with 9-ft. arm which has an effective 'reach' of almost 8-ft. radius. The full speed-feed pre-selector saves valuable time by allowing the operator to set one speed-feed combination ahead. The special sliding bed plate base gives us 30 feet of mobility—more than enough to drill and bore 10 bases at a time."

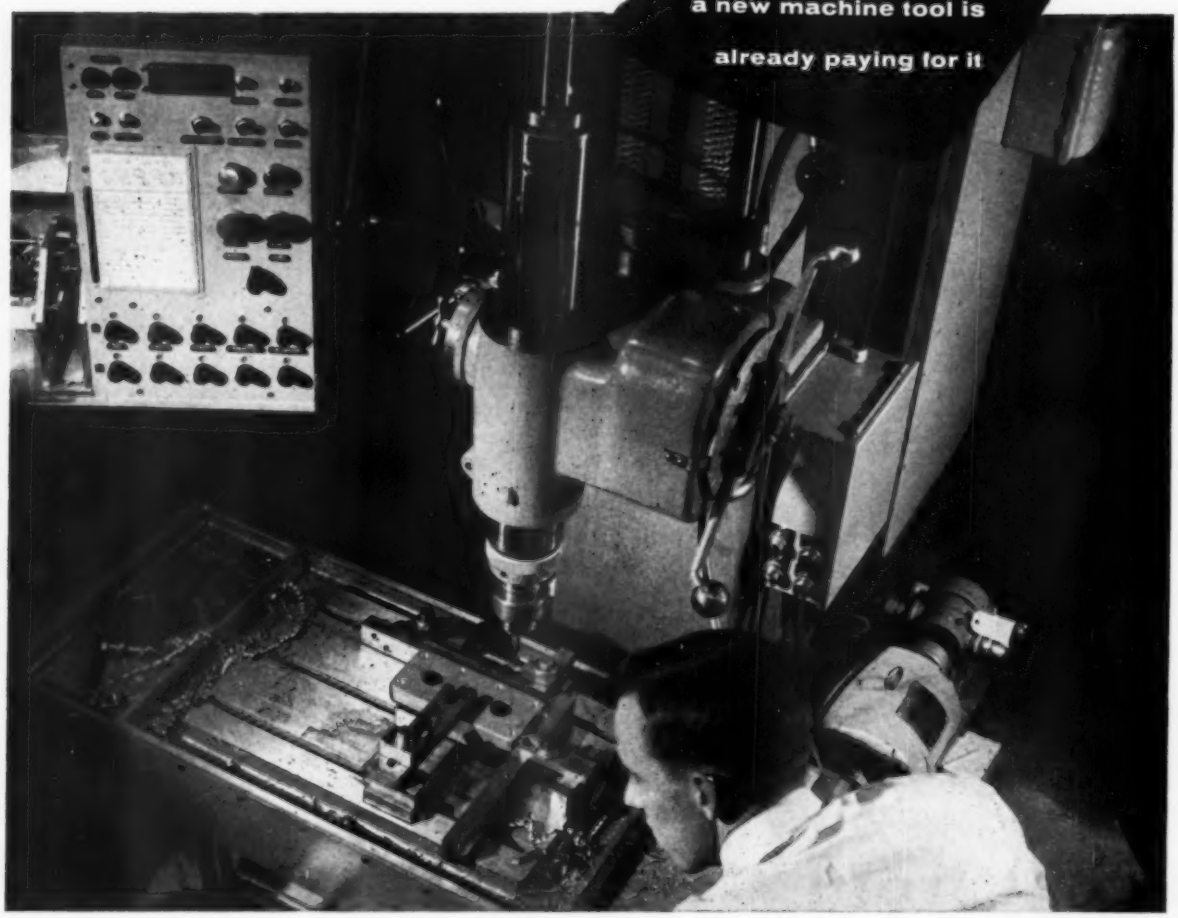
Carlton engineers will be glad to work with your engineers in laying out the most efficient radial drill set-up for your requirements. For maximum hole drilling and boring production today and tomorrow, check Carlton now. The Carlton Machine Tool Co., Cincinnati 25, Ohio.

Carlton *specialists in radial drills*

CIRCLE 255 READER SERVICE CARD

JONES & LAMSON "AUTOMATION"

the man who needs a new machine tool is already paying for it



Numerical control positioning eliminates jigs – saves time

The J&L Numerically Controlled Positioning Table quickly and accurately positions work pieces to an accuracy of ±.001" — without jigs. And it can do it economically with any lot size down to a single piece.

For instance: in one installation, where precision parts previously had been machined on a conventional spacing table, J&L's new equipment achieved cycle time savings of six minutes per piece and set-up savings of over 116 minutes per set-up, or a total savings of 6.95 hours on a lot of 50 pieces.

In another plant, the cost of building $4,000 worth of jigs was eliminated during the first six weeks of operation. And in still another operation, the positioning table not only reduced set-up and cycle time, but also eliminated the storing, handling and maintenance of $29,000 worth of jigs.

You can get in on this kind of savings too. Write to Jones & Lamson Machine Company, 502 Clinton Street, Springfield, Vermont.

Turret Lathes • Fay Automatic Lathes • Milling & Centering Machines • Thread & Form Grinders • Optical Comparators • Thread Tools

DISCOVERED!

...new way to keep cutting fluids as fresh as a daisy!

SEE NEXT TWO PAGES

CIRCLE 257 READER SERVICE CARD

DISCOVERED...A NEW WAY TO KEEP COOLANTS FRESH AS A DAISY!

Shop tests show ELCIDE 75 keeps cutting fluids fresh longer than ever before

Now . . . there's a new and better way to control the harmful bacteria that cause oil-water emulsion breakdown, acidic corrosion, and rancid odor. It's Elcide 75 . . . a product directly related to one of the most powerful bacteria killers used in medical science today . . . a material that has proved itself in the exacting field of surgical practice and has now been adapted to solve the problem of bacterial growth in soluble oil emulsions.

A large Midwestern manufacturing plant tested Elcide 75 under actual job conditions.

They found that one ounce of Elcide 75 added to each 4 gallons of oil-water emulsion . . .

extended useful life of the emulsion 5½ times . . .

greatly reduced cutting oil requirements . . .

delayed odor and emulsion break for 22 weeks, while untreated machines had to be dumped at the end of four weeks . . .

proportionately reduced down time for recharging . . .

was safe and nontoxic . . .

eliminated bacterial slime and reduced acidic corrosion . . .

drastically reduced their disposal problems.

WHAT ELCIDE 75 CAN DO FOR YOU

This combination of inhibitors can extend the life of your oil-water emulsions 2 to 4 times, or more, and can dramatically cut your oil-concentrate purchases. At the same time, production will increase because you have less down time for recharging.

ELI LILLY AND COMPANY · AGRICULTURAL AND INDUSTRIAL PRODUCTS DIVISION
INDIANAPOLIS 6, INDIANA TELEPHONE: MELROSE 6-2211

CIRCLE 258 READER SERVICE CARD

This is one of the causes of emulsion trouble. These are *Pseudomonads*, one of the many harmful types of bacteria found in oil-water emulsions. These, and other bacteria, enter emulsions through the air, water, and plant debris. They set the stage for a chain reaction which causes odor, corrosion, and costly emulsion breakdown.

Prior to Elcide 75, no single inhibitor was able to control the full range of bacterial growth. Certain of these bacteria quickly develop resistance to single inhibitors and continue to flourish. Now, Elcide 75 controls a wider range of bacteria because it is an effective combination of bactericidal agents. This has been proved in shop tests.

In certain areas where waste-oil disposal is a problem, the use of Elcide 75 proportionately reduces the size of the problem.

Elcide 75 also contributes to better products and longer machine-tool life. Bacterial contamination causes acidic decomposition of the emulsion and sets up conditions for corrosion. By controlling the bacteria, you eliminate this source of trouble.

Employees like Elcide 75 because, when added to the emulsion, it is completely safe. In another recent test involving over 1000 machines, it was shown that Elcide 75 was safe, nontoxic, and harmless to sensitive skin. It also reduces the chance for bacterial infection caused by contaminated emulsion.

YOU KNOW WHAT YOU GET WHEN YOU BUY ELCIDE 75

With Elcide 75, you know you have the proper amount for effective treatment because you add it to your emulsions right in your plant. The standard recommendation is one ounce of Elcide 75 per 4 gallons of oil-water emulsion.

PROVE IT TO YOURSELF... TRY ELCIDE 75 IN YOUR PLANT

The best way to determine the value of Elcide 75 is to try it under your normal plant conditions, using your regular oil-water emulsion. After you've had an opportunity to compare results, we believe you'll agree that Elcide 75 is a valuable discovery that will greatly increase your plant efficiency.

PRODUCT SPECIFICATIONS ELCIDE 75

(Lilly's brand of bactericide for cutting fluids)

Active Ingredients—Thimerosal (Sodium Ethylmercuri Thiosalicylate) and Sodium o-phenylphenate.

Package	Price per Gal.
1-gallon polyethylene . . .	$8.50
5-gallon polyethylene . . .	$8.00
55-gallon stainless steel . . .	$6.50

Terms: 1%, 10th prox.; net, 30th prox. F.O.B. Indianapolis. Transportation paid via carrier of our selection.

For further information or to place your order, phone or write.

ELCIDE 75™

PATENT PENDING

Lilly

CIRCLE 259 READER SERVICE CARD

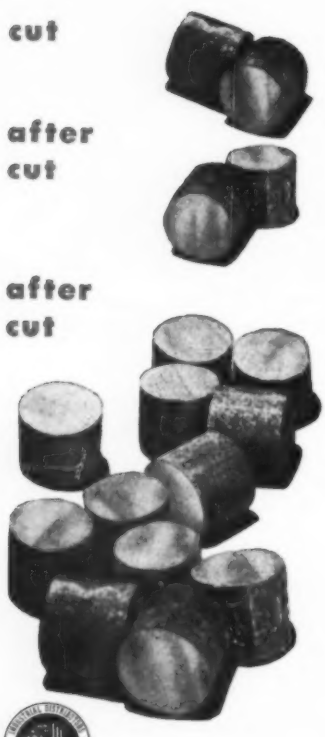
TECHNITE® POWER HACK SAW BLADES

stay hard, sharp and accurate

cut

after cut

after cut



See Your Capewell Distributor

CAPEWELL

THE CAPEWELL MFG. CO.
HARTFORD 2, CONN.

Letters...

To American Machinist
330 W 42nd St, NY 36, NY

Carbides spark deposited

Dear Sirs:
We would like the address of the company that makes the Sparcard puttin'-on tool mentioned in your article (*AM*—Jan 5 '58, p110).

N O Broce
Quincy, Mass

The Sparcard tool is made in England and is not yet available in the US. Try writing to Impregnated Diamond Products, Ltd, Tuffley Crescent, Gloucester, England—Ed.

Tool steels for aircraft

Dear Sirs:
This refers to your article titled "Are tool steels the answer to high-speed flight?" (*AM*—Mar 10 '58, p106). At the end of the article you show a list of producers of the AISI H11 type hot-work tool steel listing five producers but not including Columbia's FIREDIE.

On page 65 of your Jan 13 issue we ran a full-page ad showing the AISI identification and type classification of hot-work steels—one of a series of six ads covering tool steels—and we listed our trade names opposite the proper types.

We produce this grade in bars and forgings. The fact is that we were one of the first tool steel companies to produce this analysis for hot-work steel, and it was developed for die-casting dies. This goes back quite a period prior to World War II when die casting was just beginning to develop.

Robert M Sandberg, *Vice Pres*
Columbia Tool Steel Co
Chicago Heights, Ill

We did know that Columbia produces the H11 type steel as do a number of other companies that were not listed in this article. You will find Columbia's FIREDIE listed in our tool-steel listings in our Special Report No. 379, "How to Work Steel," originally published in 1954 and still being distributed in reprinted form.

However, in this particular article we were discussing aircraft structural applications of H11 steel, and we decided to limit our listing to the five companies that were producing the steel in sizes

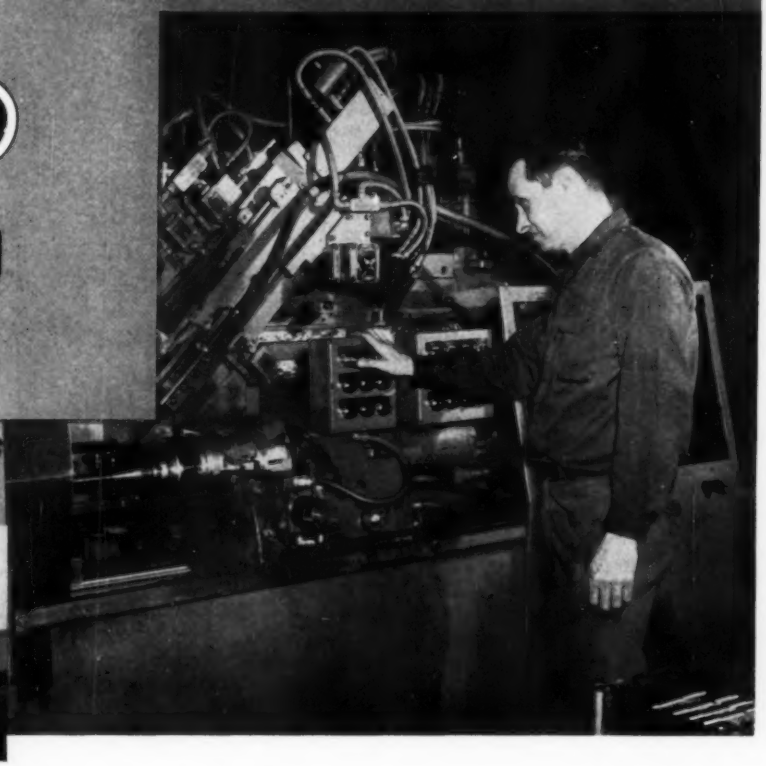
SHOPMATES

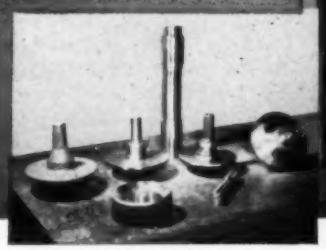
N. Jarvis

THERE GOES MAC CYCLONE.... SQUIRTIN' HIS AIR HOSE ALL OVER THE PLACE AGAIN.... EVERY HOUR ON THE HOUR!
SOME GUYS IS CAR CRAZY, SOME IS GIRL CRAZY.... HE'S AIR HOSE CRAZY AN' HE DRIVES US CRAZY!!
N. JARVIS

INCREASE PROFITS by REDUCING COSTS with BULLARD HYDRA-FEED LATHES

The experience of The National Supply Company, Toledo, Ohio, manufacturers of oil field machinery, as related by Mr. Owen U. Trumbull, Tool Engineer, can be applied to improve your profit picture.





Their BULLARD HYDRA-FEED TRACER LATHE . . .

- ★ Replaced four machines previously used
- ★ Reduced machining operations from ten to four
- ★ Held work to closer tolerances
- ★ Decreased spoilage
- ★ Simplified tooling and set-up

These are all factors that have a direct bearing on profits

The BULLARD COMPANY
Bridgeport 9, Connecticut

Remember . . . to cut costs when cutting metal . . . Buy BULLARD

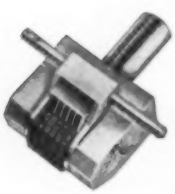
new NOBLEWEST
MARKING MACHINE
air-marks
2500
pieces per hour
AUTOMATICALLY

FEATURES
Cyclomatic Control

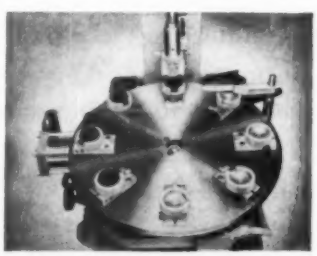
This new Model 400 dial feed marking machine is another example of NOBLEWEST'S unique ability to provide industry with high speed equipment for permanently indented marking . . . *good for the life of your product.* Featuring an air operated press head and dial feed, the basic model incorporates NOBLEWEST CYCLOMATIC Control . . . an exclusive electro-pneumatic circuit which provides continuous automatic cycling at any speed to suit operator. Supplementary controls for semi-automatic operation from a foot switch, for short runs, are also provided as well as independent operation of press head and dial feed for set-up purposes.

If you have a marking or numbering problem in steel or other metals—wood fibre, hard rubber, or plastic—NOBLEWEST makes the machines, dies and work-holding fixtures for doing the job *better, faster* at *lower cost.* For new comprehensive catalog, write Noble & Westbrook Mfg. Co., 17 Westbrook Street, East Hartford 8, Conn.

This close up shows Model 400 tooled for serial numbering plastic part shown above. Operator simply loads dial, parts are then automatically ejected after being numbered.



NOBLEWEST Automatic Numbering Heads such as used on the machine at right are standard in the marking industry. They offer unlimited applications for constant, selective and consecutive numbering. Made to the most exacting standards of quality, they are competitively priced.



A few desirable territories open to qualified representatives.

MARK IT BEST WITH NOBLEWEST IMPROVED MARKING DEVICES
NOBLEWEST
ORIGINATORS OF THE ROLL MARKING PROCESS
MARKING
NUMBERING
EMBOSSING
GRADUATING

sufficient for such structural applications at that time—Ed.

Carbides co-deposited

Dear Sirs:
We desire further information on the article, "Carbides co-deposited by plating boost wear resistance 5 to 1 or more" (*AM*—July 28 '58, p80).

Since no information was given as to the procedure to follow to secure licensing for this process, we thought you might forward this letter to them or send us their address.

A W Harwell
Birmingham, Ala

Dear Sirs:
The article about carbide co-deposition by plating was of great interest to me.

I would very much appreciate any information . . .

Donald P Welles, Jr
South Beloit, Ill

Dear Sirs:
. . . May we please have the address of the Thompson Products Co or the CEM Div of Platecraft of America, Inc . . .

Ted Sevier
Denver, Colo

Inquiries concerning the carbide co-deposition process should be addressed to Mr. Harlan Hewlett, Coit Road Works, Thompson Products Inc, 12818 Coit Road, Cleveland 8, Ohio—Ed.

Helpful Henry

by L Hoppes

"That young machinist wanted to meet you, but I told him you wouldn't be interested, that you're a career girl!"

CALENDAR

American Society of Mechanical Engineers and American Society of Lubrication Engineers—Lubrication Conference, Oct 14-16, Statler Hotel, Los Angeles, Calif.

Society of Industrial Packaging & Materials Handling Engineers—Annual Meeting and Exposition, Oct 14-16, Chicago, Coliseum, Chicago, Ill.

American Machine Tool Distributors Association—Annual Meeting, Oct 16-17, The Sheraton Plaza, Boston, Mass.

Magnesium Association—Annual Convention, Oct 16-17, Fort Shelby Hotel, Detroit, Mich.

National Safety Council—Annual Safety Congress, Oct 20-24, Hilton, Congress, Morrison, and LaSalle Hotels, Chicago, Ill.

American Gear Manufacturers Association—Semiannual Meeting, Oct 26-29, Edgewater Beach Hotel, Chicago, Ill.

American Institute of Mining, Metallurgical & Petroleum Engineers—Fall Meeting, Institute of Metals Div, Oct 27-31, Carter Hotel, Cleveland, Ohio.

American Society for Metals—National Metal Exposition and Congress, Oct 27-31, Public Auditorium, Cleveland, Ohio.

Metal Treating Institute—Annual Meeting, Oct 29-31, Hotel Cleveland, Cleveland, Ohio.

National Tool & Die Manufacturers Association — Annual Convention, Nov 5-9, Sheraton Hotel, Philadelphia, Penna.

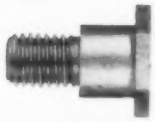
Society of the Plastics Industry—Annual Conference and Exposition, Nov 17-21, International Amphitheater and Morrison Hotel, Chicago, Ill.

American Society of Mechanical Engineers — Annual Meeting, Nov 30-Dec 5, Statler and Sheraton - McAlpin Hotels, New York, NY.

Society of Automotive Engineers—Annual Meeting and Engineering Display, Jan 12-16, Sheraton-Cadillac and Statler Hotels, Detroit, Mich.

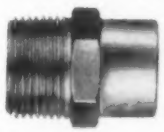
you change Only the Rolls in a Reed Thread Rolling Attachment

WHEN YOU CHANGE FROM STRAIGHT THREADING



9/16—12 UNC

TO TAPER THREADING



3/4—14 NPTF

no other equipment is needed and the change is quickly made by simply removing the roll spindles and inserting new rolls.

Each Reed Standard Series B Attachment rolls a complete range of thread sizes—both straight and taper. Adjustable roll pin support arms provide a simple adjustment for this full capacity range.

Write for your copy of Thread Rolling Attachment Bulletin B-2 for helpful information on Thread and Form Rolling

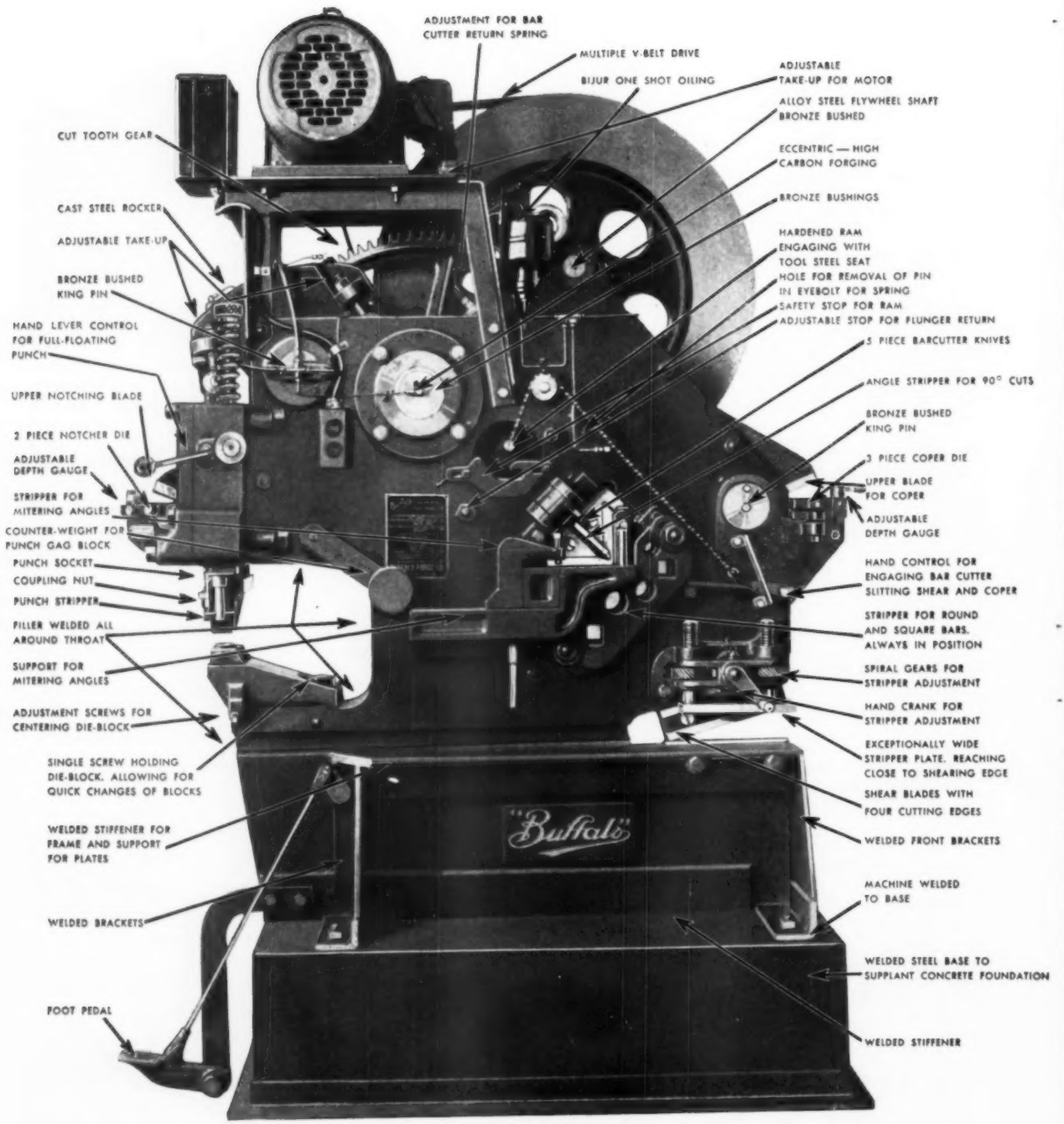
REED ROLLED THREAD DIE CO.

TRA-168

Specialists in Thread and Form Rolling Tools and Equipment

WORCESTER 1, MASSACHUSETTS, U. S. A.

Sales Offices in: Buffalo, Chicago, Cleveland, Compton, Calif., Denver, Detroit, Englewood, N. J., Houston, Indianapolis, Milwaukee, Montreal, New York City, Phila., Pittsburgh, St. Louis, Syracuse, Toronto


ADJUSTMENT FOR BAR CUTTER RETURN SPRING
MULTIPLE V-BELT DRIVE
BIJUR ONE SHOT OILING
ADJUSTABLE TAKE-UP FOR MOTOR
ALLOY STEEL FLYWHEEL SHAFT BRONZE BUSHED
CUT TOOTH GEAR
ECCENTRIC — HIGH CARBON FORGING
CAST STEEL ROCKER
BRONZE BUSHINGS
ADJUSTABLE TAKE-UP
HARDENED RAM ENGAGING WITH TOOL STEEL SEAT
BRONZE BUSHED KING PIN
HOLE FOR REMOVAL OF PIN IN EYEBOLT FOR SPRING
SAFETY STOP FOR RAM
HAND LEVER CONTROL FOR FULL-FLOATING PUNCH
ADJUSTABLE STOP FOR PLUNGER RETURN
5 PIECE BARCUTTER KNIVES
UPPER NOTCHING BLADE
ANGLE STRIPPER FOR 90° CUTS
2 PIECE NOTCHER DIE
BRONZE BUSHED KING PIN
ADJUSTABLE DEPTH GAUGE
3 PIECE COPER DIE
STRIPPER FOR MITERING ANGLES
UPPER BLADE FOR COPER
COUNTER-WEIGHT FOR PUNCH GAG BLOCK
ADJUSTABLE DEPTH GAUGE
PUNCH SOCKET
HAND CONTROL FOR ENGAGING BAR CUTTER SLITTING SHEAR AND COPER
COUPLING NUT
PUNCH STRIPPER
STRIPPER FOR ROUND AND SQUARE BARS. ALWAYS IN POSITION
FILLER WELDED ALL AROUND THROAT
SPIRAL GEARS FOR STRIPPER ADJUSTMENT
SUPPORT FOR MITERING ANGLES
HAND CRANK FOR STRIPPER ADJUSTMENT
ADJUSTMENT SCREWS FOR CENTERING DIE-BLOCK
EXCEPTIONALLY WIDE STRIPPER PLATE, REACHING CLOSE TO SHEARING EDGE
SINGLE SCREW HOLDING DIE-BLOCK, ALLOWING FOR QUICK CHANGES OF BLOCKS
SHEAR BLADES WITH FOUR CUTTING EDGES
"Buffalo"
WELDED STIFFENER FOR FRAME AND SUPPORT FOR PLATES
WELDED FRONT BRACKETS
MACHINE WELDED TO BASE
WELDED BRACKETS
WELDED STEEL BASE TO SUPPLANT CONCRETE FOUNDATION
FOOT PEDAL
WELDED STIFFENER

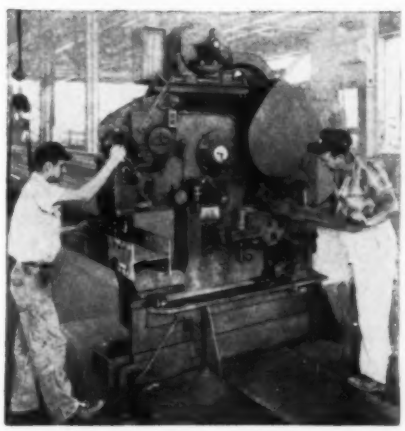
"BUFFALO" UNIVERSAL IRON WORKER — These construction details clearly show you why the "Buffalo" Universal Iron Worker does more jobs, does them better, faster, and lasts longer.

CUT, PUNCH, SHEAR, COPE, MITER AND NOTCH
WITH ONE MACHINE COST AND SPACE!

- **Low Initial Cost of *One* Machine!**
- **Versatile Output of *Six* Machines!**
- **Saves Labor, Setup and Production Time!**
- **Saves Productive Floor Space!**

Are you losing valuable time and floor space every day because you have several machines in different locations doing work which could be handled by a "Buffalo" Universal Iron Worker? This sturdy, dependable workhorse cuts, punches, shears, slits, copes, miters and notches at a very high output rate. The UIW quickly and easily handles angles, tees, channels, bars, flats. It's built to take plenty of punishment, too — with welded steel plate box frame, heavy shafts, bearings, bolsters and plungers. Centralized oiling system insures permanent proper lubrication.

See how the "Buffalo" Universal Iron Worker can profitably speed **your** operations. Phone your "Buffalo" machine tool dealer, or write for Bulletin 360-H for range of capacities and details.



Two Operations at Once!

Punching and shearing simultaneously on a "Buffalo" Universal Iron Worker.

All "Buffalo" products bring you the "Q" Factor—the built-in QUALITY which provides trouble-free satisfaction and long life.

BUFFALO FORGE COMPANY

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Buffalo Pumps Division, Buffalo, N. Y.

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

DRILLING PUNCHING SHEARING BENDING

OFF THE SHELF–

NO REBORING–

NO KEYSEATING–

NO WAITING!

TAPER-LOCK SPROCKETS
SINGLE AND DOUBLE STRAND!

NOW Taper-Lock *Double* Strand Sprockets are available—from stock—ready for the shaft without re-machining!

They offer all the advantages of Taper-Lock mounting. Easy on! Easy off! Precision machined at the factory, they come to you with accurate, concentric bores—insuring full contact between hub and shaft. Taper-Lock grips with the firmness of a shrunk-on fit!

There is no flange, no collar, no protruding part. Flush design means *safety*... If the sprocket becomes worn, you replace only the tooth part. The bushing is used again and again. And Taper-Lock bushings are interchangeable in Dodge Taper-Lock Sheaves, Couplings and Conveyor Pulleys!

Taper-Lock Sprockets and Dodge Roller Chain (made to ASA standards) are stocked by Dodge distributors. Single Strand sizes range from No. 40 to No. 160, up to 112 teeth; Double Strand from No. 40-2 to 80-2, up to 102 teeth. Write for Bulletin A-644 containing selection, installation and maintenance data.

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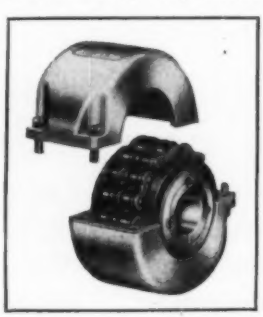
of Mishawaka, Ind.

CALL THE TRANSMISSIONEER, your local Dodge Distributor. Factory trained by Dodge, he can give you valuable help on new, cost-saving methods. Look in the *white* pages of your telephone directory for "Dodge Transmissioneer."



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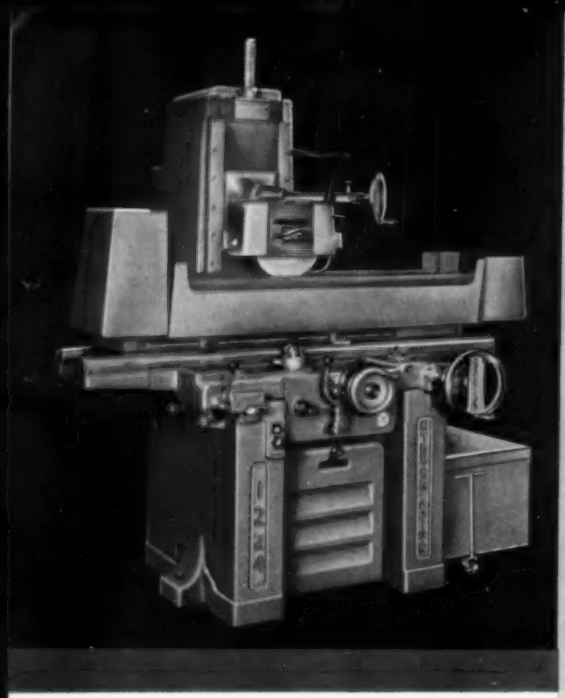
Accommodates common minor shaft misalignments. Provides strong, compact coupling. Available with covers, for appearance, safety, dirt protection and lubrication—which increases coupling life.



man-hours mean more
with features
engineered for operators

NEW HYDRABRASIVE

precision surface grinders
no. 824-no. 1218-no. 1224-no. 1230

Controls Grouped For Easy Accuracy – No knuckle busting! Every operating control is located for free, natural, physical and optical convenience. Power feeds and hand feeds (standard equipment) are interlocked for positive safety.

Hydraulic System Runs Cool – Without Extra Attachments Won't change machine dimensions, throw work out of line! A low-pressure, high-volume, air-cooled totally enclosed hydraulic system provides smooth power, shockless table reversal, and eliminates air locks.

Deep-Throated, Balanced Capacity – A full 12″ under a 12″ wheel! 18″ under the wheel available as an extra. 3 5/16″ clearance under head for grinding between die pins.

Smooth, Easy Accuracy – Saddle adjusts transversely on a precision ground screw with backlash eliminator . . . moves on ball bearing and hardened steel ways. For effortless travel up and down, head and motorized exclusive Abrasive spindle are balanced on elevating screw and ways.

Free Illustrated Catalog Shows How Hydrabrasive Operator Engineered Features Add Up To Easy Accuracy, Fast! Write For Your Copy, Now.

ABRASIVE MACHINE TOOL COMPANY
EAST PROVIDENCE, RHODE ISLAND

At the Brussel's Fair IBM's Ramac presents World History in 10 languages with the help of Skinner Solenoid Valves

Visitors to the World's Fair at Brussels are given the opportunity to submit history questions to IBM's Ramac and get their answers in any one of ten languages. Millions have been fascinated by this amazing electronic data processing machine.

Ramac is a vast library of facts. By means of 50 rotating metal disks 5,000,000 alphamerical characters can be stored and selected at the touch of a button. The Ramac can punch 100 cards a minute, transfer data from punch cards to disks at a rate of 125 cards per minute, and print reports at speeds up to 80 lines per minute.

Three Skinner V5 three-way valves are used in the access control mechanism. One valve engages the access arm at the exact location of the disk, while the second valve disengages the arm after the read-write sequence has been completed. The third valve positions the read-write head at the precise location on the proper disk tract.

Skinner has a wide selection of solenoid valves for all types of applications. If you have a control problem, why not take it to a Skinner engineer or representative. You will find Skinner representatives listed in the Yellow Pages or write direct to Department 300.

SKINNER ELECTRIC VALVES
THE CREST OF QUALITY

SKINNER ELECTRIC VALVE DIVISION
NEW BRITAIN CONNECTICUT
105 EDGEWOOD AVENUE

SPOT NEWS...

- **Look for the Air Force to order prime contractors** to hand more work to subcontractors. In the shiftover to missile output, tendency has been for primes to handle more and more work themselves. Now, the Air Force will insist on a greater spread of work so as to keep a nucleus of plant capacity and skills in being, particularly among primes using government facilities.
- **Some 529 exhibitors were on hand** for Italy's First Machine Tool Exhibition in Milan in September with a display of 2200 machines, ranging from small lathes to giant plano-millers. Machines showed a trend toward more automatic cycling, but only one, a copying lathe, had numerical control. (One reason: only Olivetti and Fiat employ it in Italy.) Purpose of the Show: to promote Italian machine tools among the Italians, who last year imported 59% of their machines, with West Germany as the leading supplier.
- **Army has junked the Dart antitank missile from its arsenal,** possibly in favor of a foreign one, believed to be French. Reason is that other missiles under consideration are cheaper to make, can be ready sooner.
- **Profit-sharing plan package is being offered to small and medium-sized firms** for about $500 a year by Boston's Putnam Fund Distributors Inc and R P Burroughs Co Inc. Putnam and Burroughs for an initial fee will tailor a plan to your company, then will handle all the paperwork and investments involved for $250 plus per-person costs a year after that.
- **Navy is running into a materials failure problem on the Polaris missile.** Steel casing for the first stage is being put under much higher stress than it should be, resulting in a brittle reaction. Either the heat-treating or welding procedures must be changed soon, the Pentagon says.
- **U S must train 35,000 technicians a year from now on or lose the space race**—and that's 8000 more than it's doing now, according to Karl O Werwath, president of Milwaukee School of Engineering, who claims the U S now has 9-million skilled craftsmen at one end of the production system and 950,000 engineers and scientists at the other. What's needed is more people in between, he says.
- **Cathode metal sputtering may be used to produce printed metal circuits.** This century-old technique (ionized gas molecules bombard a cathode, dislodging metal atoms, which redeposit on nearby surfaces) may be used to lay down entire circuits. High-melting point metals, such as Ti and Ta can be laid down in films as resistors in printed circuits, allowing lines and patterns of any desired shape and size to be formed.
- **Space age is going to mean 100,000 new jobs,** an additional $1 billion for electronic purchases, and 500 new companies in southern California alone by 1965, it was recently predicted by H J Petersen, executive VP and founder of Los Angeles' Topp Industries, $10-million-a-year electronics firm.
- **Used fork truck center,** said to be the first established on a national scale, has been opened by Clark Equipment Co in Newark, N J. Facility has $250,000 worth on hand, will buy, sell or trade.

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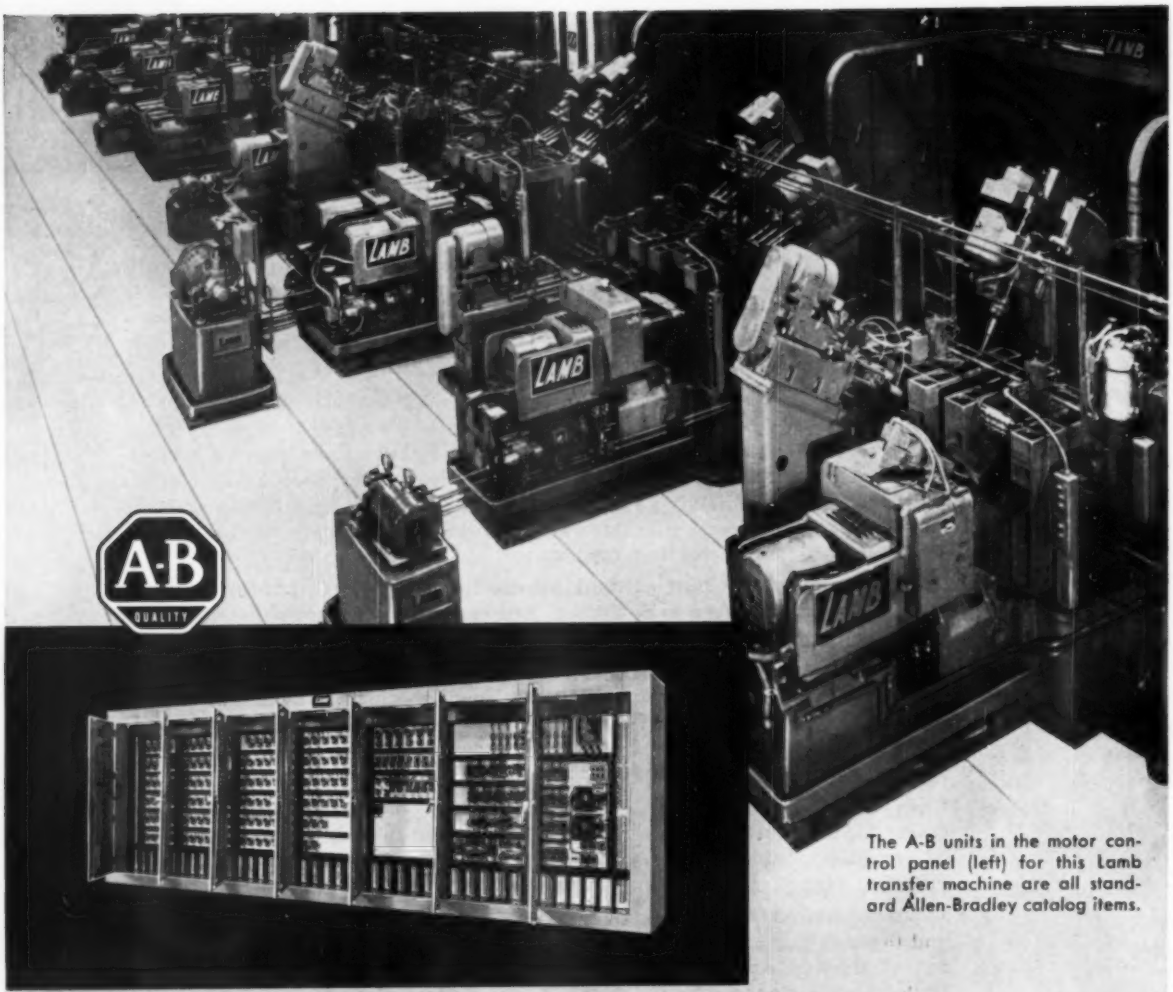


The A-B units in the motor control panel (left) for this Lamb transfer machine are all standard Allen-Bradley catalog items.

When only the best will do...

ALLEN-BRADLEY
Quality Motor Control

It's sound engineering to insist that your automatic production machines have the best in motor control . . . and that means Allen-Bradley—the *quality* motor control.

Allen-Bradley motor control will provide the reliability you need. It's the simple solenoid design—around which *all* Allen-Bradley relays, contactors, and starters are built—that makes this possible. There is only ONE moving part . . . all trouble causing bearings, pins, and pivots are eliminated. This is your assurance of *millions* of trouble free operations. And the double break, silver alloy contacts—standard throughout the Allen-Bradley line—never need service attention. They are always in perfect operating condition.

Protect your production machines from control failures . . . insist on Allen-Bradley motor control. It's the *quality* line preferred throughout industry.

Allen-Bradley Co., 1310 S. Second St., Milwaukee 4, Wis.—In Canada: Allen-Bradley Canada Ltd., Galt, Ont.

Another automatic production machine "goes Allen-Bradley"

WASHINGTON...

Capital goods outlook brightens...

Government forecasters are more cheerful about the economic outlook affecting machinery and equipment. Three late developments point to the beginning of a solid pickup in business for this key industry and they add to the general optimism for a broad forward movement in the economy this fall.

First off, machine tool makers are reporting a stepup in orders for their products—a clear sign that businessmen are planning to expand production facilities.

Second, manufacturers have notified the government of plans to lift their capital spending on plant and equipment the rest of the year. They are now in a better financial position to do so than at any time this year, what with working capital of U S corporations on the rise again.

Last, productivity is rising sharply, insuring a healthy boost in profits. Profits on manufacturing corporations have jumped in the second quarter of this year after a 15-month decline. While sales rose only 3%, profits rose 15% as compared with the first quarter.

This is dollars-and-cents proof to businessmen that their heavy investment in automated and more efficient machinery pays off; adds a spur for them to keep spending on new equipment.

All the news is not bright, however. Government experts don't think unemployment will come down much before next spring; and they expect inflationary pressures to remain a problem for some time to come.

Military budget squeeze...

The military is going through its annual budget squeezing process, and the outlook is that the axe will chop hard and clean on many big name projects. The administration wants to keep appropriations within $42 billion for next year.

Being touted for the chopping block are such things as the Titan ICBM missile, B-58 bomber production, and Navy's Martin SeaMaster patrol plane.

Many Pentagon officials believe the time is overdue for selections among missiles designed to do the same job. And they point to the recent success of the Atlas ICBM as grounds to scrub the Titan. Another decision is needed between the Air Force Thor and Army Jupiter IRBMs, high Pentagon people say.

Navy is concerned about its nuclear submarine program. Congress voted money to build nine of the Polaris-toting nuclear subs this fiscal year. But, Secretary of Defense McElroy has held Navy down to only starting five of the Polaris subs—a hold back of around $400 million. McElroy said he wanted to see more proof of the weapon's success before pumping more money into the program.

Full-scale firing of the Polaris missile is slated within the next few months.

Even within the Navy, some of the brass are afraid the nuclear submarine program—regular nuclear subs in addition to the Polaris-carrying jobs—are pushing other programs out in the cold. Navy has been getting money for about five nuclear subs a year.

Wages—still up...

President Eisenhower and his economic advisers see nothing much to cheer about in recent wage negotiations. They were hoping to see a period of relative wage stability created to take some of the upward pressure off prices and inflation.

Hopes were raised, briefly, during wage negotiations in the auto industry that a moderate settlement would be reached that would set a pattern for other industries.

But government economists differ with union and company officials that the 30% boost in wages and other benefits finally agreed on was "anti-inflationary."

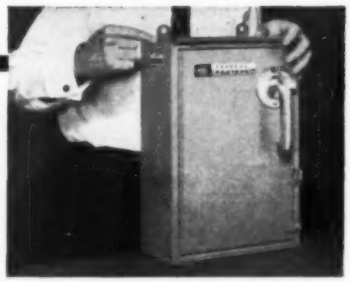
The government experts agree that it was not a sharp rise in benefits. But they don't see it as "anti-inflationary" either; rather feel it will add some further inflationary pressures, even if only slightly. Their fear is that it may result in a new price hikes on 1959 models, perhaps as much as 2 to 4%.

Other union leaders aren't buying the administration's ideas, either. They give every indication of using the auto settlement as a springboard and of scaling their demands upward from there.

The way it looks to most government forecasters now, the auto settlement will be at the low end of the scale for wage settlements over the next six to nine months. Their feeling is that the Steel Workers in negotiations this spring will set the high mark for settlements received.

Another union they're keeping their eye on is the Mine Workers. At the time AMERICAN MACHINIST went to press, John L Lewis was optimistic about getting at least twice as much as the Auto Workers in his bargaining with coal operators.

Before you buy Motor Controls... CONSIDER THESE FEATURES!



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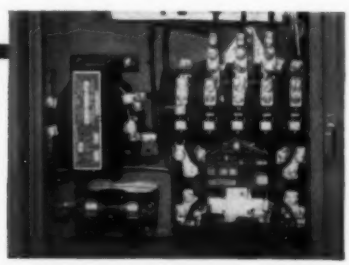
Welded seams...sturdy piano hinge...slotted Hex cover retaining screws...cast aluminum handle...padlock provisions on handle *and* door...oil resistant neoprene gasket...mechanical cover interlock...rust-proof finish.

COOLER, SAFER SWITCHES

Visible blades...crossbar *under the blades*...deionizing arc quenchers...dual switchblade construction...only 2 joints per pole...pressure-type solderless lugs.



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Easy-to-change, silver cadmium contacts...contact assembly rides on ball bearings...operating coil easily accessible...flexible coil leads...bi-metallic overload relay for manual or automatic resetting.

FEDERAL PACIFIC'S TYPE "K", NEMA XII COMBINATION MOTOR STARTER

Designed for mass production industrial equipment, the quality features found in the Type "K" are typical of the kind of construction that goes into every device in the Federal Pacific line. Federal Pacific's manual or magnetic motor controls are available in NEMA sizes 0 through 5—with accessories to meet all practical requirements. Bulletin 514 gives full details on combination starters. For this or for specific information to cover your particular needs, write to: FEDERAL PACIFIC ELECTRIC COMPANY, General Offices: Newark, New Jersey.

FEDERAL FPE PACIFIC

The Best in Electrical Distribution and Control Equipment

TRENDS

DETROIT...

Filling the pipeline . . .

With labor peace practically assured, automakers are busily loading dealers with announcement week stocks. All companies were producing 1959 models on bullish schedules by the second week in October.

Optimism was heightened by Buick's first-day sales performance. Based on a canvass of 42 key dealers, who delivered 271 cars and took orders for 146 more, General Manager E T Ragsdale projected a 20,000-unit total for his 3500 dealers. He called it "by far the most enthusiastic reception given any new model Buick."

Prices up again . . .

Any hope of holding the price line was dispelled by the average 2% increase recently announced by General Motors. However, in many cases the customer will benefit by standard equipment that cost extra in 1958. Chevrolet, for example, has dropped its price leading Del Ray series (stripped 1958 cost—$1905) in favor of the former middle-line Biscayne, which will sell for $2041 for a comparable 2-door sedan. Comparing Biscaynes, though, it represents an increase of only $4.

The lowest priced Buick now costs about $100 more than last year's equivalent but, conversely, the highest price model in the line is $800 cheaper. Cadillac, on the other hand, has held to 1958 prices in most models.

Small car confirmed . . .

A series of leading questions tossed at Chevrolet General Manager E N Cole during a recent press conference trapped him into admitting for the first time the existence of GM's small car project.

In answer to the inevitable question, he said: "I can assure you that we haven't purchased one pound of productive material for a small car."

Pressed for a definition of "productive material," he dropped his guard and answered "what we actually used in the car, not tools and dies."

And like night follows day, the next question was "Would you make the same statement that Chevrolet had not made any purchases of tools and dies for a smaller car?"

"No sir," he declared, "but that does not mean that we will purchase one pound of productive material to run over these tools and dies."

Reporters present were reminded that back in 1947, GM had carried a small car project to the point where a plant was constructed in Cleveland and never used. Best information on the current project indicates that the former Chevrolet heavy duty truck plant at Willow Run near Detroit will be converted for small car assembly. Target date for public introduction is September 1959.

The new Chevrolet . . .

1955 saw Chevrolet transform itself from a rather stodgy family hack into a real automobile, with high style and the hottest performance on the American road for those who wanted the new and optional V-8 engine. In addition to obviously all-new sheet metal and mechanical parts, it was a complete change in character.

For 1959, once again Chevy is acting in a new role. Through four years of transition it has reached such a stage of optional luxuriousness and standard spaciousness that before the year is out, it should be brought to mock trial for assault with intent to murder the medium price car market.

Biggest feature is the dramatically new styling, designed to emphasize the physical fact that it is the biggest car in its field. New interchangeability of basic GM body parts is most apparent in the cowl area. Chevrolet's 1740 sq-in. windshield will fit in a 1959 Cadillac.

A 10% gain in economy is claimed, gained by redesigning cams in all engines to reduce valve lift. However, hot rodders can still buy optional fuel injection and—shades of 1938—a 4-speed manual gear shift with the stick mounted in the center of the floor.

Copywriter's heaven . . .

Up in Lansing, Mich, where Oldsmobiles are made, people use names that are hard to translate, even into English. No one there ever says Oldsmobile—it's the "Rocket Olds." The styling is now called the "Linear Look." The series, as usual, is named "Dynamic 88, Super 88, and Ninety-eight" in order of expense.

Even the mechanical features are glorified. The transmission is the "Jetaway" hydra-matic. Gasoline passes through the "Econ-o-way" carburetor on its way to the "Rocket" engine. The "Wide-Stance" chassis with its "Guard-Beam" frame produces a "Glide Ride". The driver sits on his "Custom Lounge" seat, grips the "Safety-Vee" wheel, and peers through the "Vista - Panoramic" windshield to maneuver his "Scenicoupe" through traffic.

51% More Production

when drilled with the

BENCH MODEL BURGMASTER®
Turret Drilling Machine

JOB DATA:

Part: Gas furnace pilot burner head.

Location: General Controls Co., Glendale, Calif.

Material: Type 2202 stainless steel.

Operation: Drill 10 holes No. 56 drill size.
Drill 1 hole No. 42 drill size.
Drill 1 hole No. 37 drill size.

All hole positions indexed radially around jet axis. Turret is double tooled.

Former Method: Production—58 pieces per hour, standard, on a 3 spindle gang drill. Fixture was progressively moved from one spindle to the next on 8' table.

Burgmaster: Production—88 pieces per hour, standard, with actual production running 130% over standard. Operator fatigue greatly reduced. All holes now drilled from one operator position on a stationary rotating fixture. Floor area requirements per machine reduced 50%. Based on savings alone this machine paid for itself in less than 5 weeks!

Paid for itself out of savings in less than 5 weeks!

THE BURGMASTER TURRET DRILLING MACHINE speeds all second operations—*center drills, drills, reams, taps, spot-faces, countersinks,* and *counterbores!*

SELF-INDEXING—Turret instantly power-indexes to successive station after each individual operation is completed!

6 STATIONS—Only one live spindle! Each spindle operates at its own predetermined speed. Two complete ranges cover 350 to 6200 rpm.

¼" CAPACITY IN STEEL—Larger hole sizes in softer materials.

For *more* parts per hour, for *lower* costs, put your second operations on a BENCH MODEL BURGMASTER TURRET DRILLING MACHINE! Here's a tool that not only produces more parts faster...it costs *far less* than conventional equipment often used for the same job! Write for circulars and specifications!

BURGMASTER BENCH MODEL 6 SPINDLE AUTO INDEXING TURRET DRILL & TAP MACHINE

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AIRCRAFT and MISSILES...

TRENDS

Comeback for planes?

Despite all the furore in the last year or two about the aircraft industry's switchover from manned aircraft to missiles, it now looks as though military planes will be around for a long time to come.

Reason is that if America is destined to go through a series of limited "brush fire wars," such as Korea, Lebanon and now Matsu and Quemoy, missiles won't be used for fear of touching off World War III.

On orders for planes alone, at least a couple of established companies have come back solidly in recent months.

Republic Aviation, for example, has been slow to diversify into missiles and electronics, yet it has gone up four notches in defense contractor standings with last year's order for quantity production of the supersonic F-105 fighter-bomber.

Grumman Aircraft, Long Island neighbor of Republic, is another outfit slow to go into missiles, yet it too has leaped back into the defense picture in a big way with new production orders for the WF-2 early warning radar plane and fighter trainers.

Out of the list of the top 100 defense contractors not long ago, Grumman is now Number 18.

West Coast outlook: steady but . . .

Aircraft and missile business in southern California, although up somewhere between 5 and 10% since the rock bottom struck in the first quarter this year, will stay pretty much at current levels at least through 1959.

Defense employment in metropolitan Los Angeles now totals 182,500, compared with 230,000 in the spring of 1957. But defense payrolls are up, despite the drop in number of employees, because of recent wage adjustments. The higher skills required for missile work have been a factor in upping wages, too. Total weekly defense payroll in the Los Angeles area is running about $22.7 million.

Combined area defense backlogs amounted to about $3.4 billion at the end of the first quarter, compared with a $5-billion backlog in the corresponding period of 1957.

But in spite of the improved aircraft and missile picture, small plants and shops in the $50,000 bracket continue to go out of business. Equipment from about 150 shops has been auctioned off this year in the Los Angeles area alone. One of the largest auctioneers reports he's still holding an average of two such small plant auctions a week.

And this same auctioneer reports that in recent weeks he has had a 40% increase in calls inviting him to discuss liquidation of small tool and die shops.

But purchasers are still willing to pay good prices for equipment despite the high mortality rate of shops and the frequency of auctions.

Auction prices still high...

One auctioneer just a few weeks ago sold off some lathes, mills and inspection equipment and got as good a price as any he has chalked up in the last five years. But even though prices are staying up, the number of bidders has gone down. A couple of years ago, 8 or 10 people would bid in on a tool. Now only two or three bid. This could be an indication that prices, too, might fall off.

Most used equipment buying on the West Coast has been by substantial shops in the $100,000-to-$300,000 class, because these firms and the very large companies have taken up the work previously done by the small shops.

It seems that medium-sized shops, through taking up available work, through mergers, economy cuts and a general tightening-up of operating methods, have been able to weather the storm and can now survive easily at current business levels.

But small shops, with their high overhead, are too often forced to take jobs at a low margin, so they continue to close their doors.

Those Los Angeles subs still in the field are engaged in a scramble for new markets. The shop that once had plenty to keep it busy in the old home town is now forced to range the country for jobs.

No axe for Vanguard...

The Navy's Vanguard satellite program won't be killed as a result of its failures—despite persistent rumors to the contrary.

The program will go on as planned—four more shoots at about six-week intervals. This means the program will run into next spring, when it is believed the new National Aeronautics and Space Agency will take over the project, keeping the present missile and technical team. Success of succeeding shoots may well determine how much of the present Vanguard project is retained, however.

← CIRCLE 271 READER SERVICE CARD

how to produce less for the scrap heap

capacities to
10' by 12 foot

Check your scrap "production." A certain amount of scrap is to be expected. But, if your scrap heap is growing out of bounds chances are, your shear is a contributor.

Even a skilled operator is at the mercy of a "cranky," inaccurate shear. Put the same operator on a Lodge & Shipley Shear with "built-in" accuracy and watch production flow. Lodge & Shipley Power Squaring Shears are proved for accurate shearing . . . produce far less for the scrap heap and far more for production.

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your LODGE-ical choice . . .

Lodge & Shipley

MACHINE TOOLS... TRENDS

Chrysler has new transmission...

Chrysler has been asking for bids on a newly-designed aluminum transmission to be made at its Kokomo, Ind, plant. This unit, which is not the trans-axle job so long talked about, is planned for Chrysler's small car as well as for its regular lines. It is to take the place of the present cast-iron transmission.

Tooling orders for the valve body machines already have been placed with builders. Machine tools for the transmission case are yet to be purchased.

Just as this news comes from Chrysler, Buick is reported to have revived interest in its trans-axle program. The go-ahead has not yet been given, but chances are that Buick will proceed in the near future.

Detroit Transmission Division of General Motors has been trying to make up its mind between two courses of action. One is to make a major transmission change for the 1960 model, which would preclude another big switch for some time after that. The other is to be satisfied with relatively minor changes now and make the big change—presumably to the trans-axle unit—a year hence. The management is believed to have decided upon the second of the two courses.

Chrysler working on small car...

Chrysler is reported to be working at full speed at its Trenton, Mich, plant on engineering development of the engine for its small car. It seems doubtful whether any orders have yet been placed with machine tool builders. But this business is not far off, for Chrysler apparently is as committed to the small car as are General Motors and Ford.

Rebuilding of existing machines will be an important factor in the tooling for transmissions as well as for small motors.

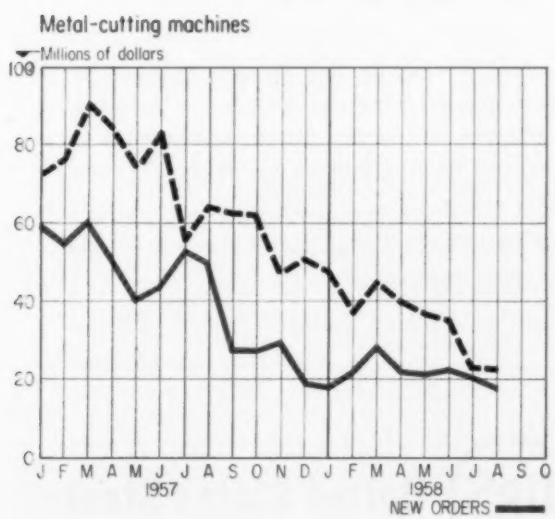
Landis Tool buys John Lund...

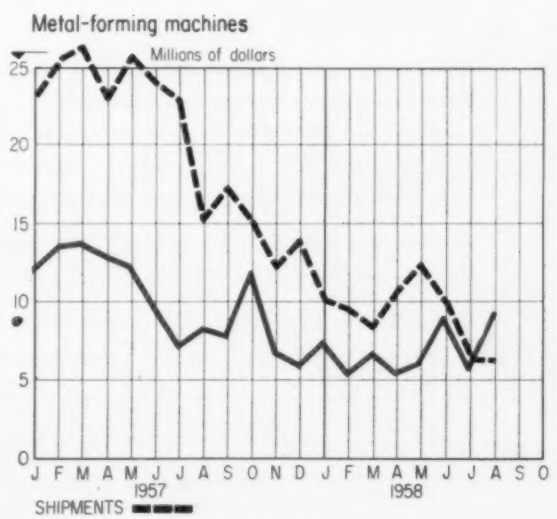
Landis Tool Co, Waynesboro, Pa, has purchased John Lund, Ltd, maker of grinding and fine boring machines at Cross Hills, near Keighley, in Yorkshire, England. The British company hereafter will be known as Landis-Lund Ltd, with John E Hill, the present managing director, still in charge. M A Hollengreen, president of Landis Tool Co, will be chairman and J H Smith secretary.

This new British subsidiary will continue to build its present lines of machines. In addition, it will make the special and semi-special grinding machines now manufactured by Landis at Waynesboro and by Gardner Machine Co, a Landis subsidiary, at South Beloit, Wis.

U S machine wins out...

Latest word from the West Coast is that the aircraft builder who reportedly bought a basic prototype big machine tool at the insistence of the Air Force did not do so after all. Top management of the company went to the Air Force and persuaded it to consent to purchase of a U S machine. The price had been in favor of the foreign machine.





Acres of roof deck panels made from USS Galvanized Steel Sheets

—the zinc stays on

Acres of galvanized steel roof and floor panels are made at Fenestra's West Elizabeth, Pennsylvania, plant. These panels find use in schools, office buildings, stores, plants and many other types of buildings. Fenestra uses USS Galvanized Steel because the continuously hot dip zinc coating remains unbroken through all the fabrication processes; cutting, creasing, cold forming, shearing and welding. The zinc stays on to provide the high degree of protection desired.

You can get the same results using USS Galvanized Steel Sheets. Call our local sales office or write United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

Unless otherwise ordered, USS Galvanized Steel Sheets are chemically treated to inhibit the formation of white oxide—sometimes called wet storage stain.

USS is a registered trademark

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Columbia-Geneva Steel—San Francisco
Tennessee Coal & Iron—Fairfield, Alabama
American Steel & Wire—Cleveland
United States Steel Supply—Steel Service Centers
United States Steel Export Company

United States Steel

MATERIALS... TRENDS

Contracts for beryllium...

USAF technical people are plugging hardest for beryllium among the military—and for good reason. It's an ideal missile material. Just released by Battelle Memorial Institute is a report titled "Beryllium for Structural Applications." It describes Air Force contracts with various organizations. Brush Beryllium has a $230,000 contract to roll beryllium sheet plus a $90,000 contract to develop beryllium alloys.

Alloyd Research Corp has a $79,000 contract to study ductility. The Martin Company got $70,000 to make a beryllium part. More contracts are underway from the other services and the AEC.

If technical problems can be overcome, the metal is touted as a solution to many of the materials problems in space experiments. However, experts admit the odds are strong against a quick breakthrough. Drawbacks are brittleness and high cost—now about $150 a pound. Advantages (primary in weight saving, high-temperature strength and stiffness) are big.

For ultimate benefits, metal experts say, beryllium must be made as ductile as aluminum alloys before it can be widely used as a structural material for missiles and aircraft. Even then, cost might limit its use. However, the same problems existed for titanium only a few years ago and these obstacles are rapidly being hurdled.

With limited ductility, beryllium could be used for such structural items as air-inlet diffuser cones in missiles and give a 50% saving in weight; the final stages of satellite shells could be cut 50% over present magnesium construction. Missile aerodynamic control surfaces, both fixed and movable, can be lightened by 50% over present steel and plastic materials.

Eventual success or failure rests largely with metalworking production specialists. Real know-how and ingenuity are needed to make beryllium usable. The incentive: Contracts, or sub-contracts, at good prices, for people who can work it. A price of $150 a pound seems high but this is relative. Compare it to the fuel and control costs to put each pound of missile into space.

Aluminum temper designations...

Increasing application of stress-relief treatments to aluminum alloys has led the Aluminum Association to assign a new series of temper designations to selected mill products. Developed by the association's Technical Committee, the new series applies only to heat-treatable alloys.

In this designation, three digits follow the letter -T, such as -T351, -T851, and -T651. The digit in the first position indicates the basic temper. Following it, the second digit, arbitrarily assigned, is the "key" denoting that the material has been stress-relieved when a "5" appears. The digit in the third, or last place, indicates the method of stress relief. For example, digit 1 in the third position shows stress relief by stretching, while the number 2 indicates that compression was used. Numbers 3 through 9 are reserved for other methods.

Alloys in the 7000 series, such as 7075 and 7079, that have been stress-relieved by stretching after solution heat treatment will be designated -W51. In the artificially aged condition, they will be labeled -T651.

Spray-applied protectant...

Called "an entirely new concept" of applying protective resins to concrete, wood, metals and other surfaces subject to corrosion, erosion, or chemical damage, equipment now is available to spray-apply films of 100% solids. **Developed by** Hodges Chemical Co, Redwood City, Calif, the formulating applicator machine also handles 100% reactive resins used primarily for potting and casting, and as **high-strength adhesives.**

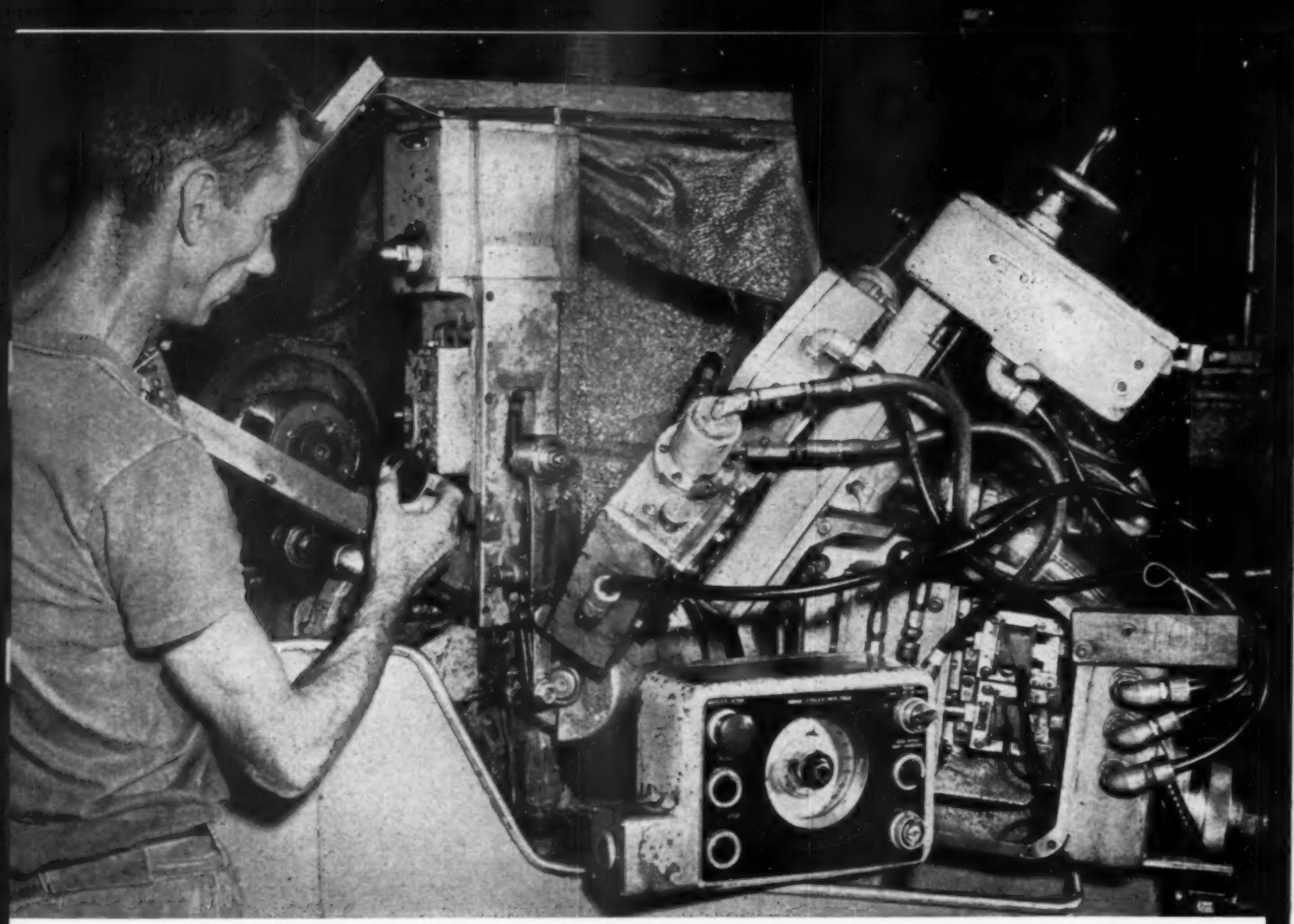
Thermo-setting films of high chemical resistance, says Hodges, may be applied in thicknesses of 0.010 to 0.050 in. in one spray operation. The same materials, incorporating inert aggregate fillers, may be applied as sprayed mortar films up to ¼-in. thick. Hodges currently is doing spray-application work for customers; plans to license the machine on a national and international basis.

New iron powder...

Said to open the way to countless new applications of powder metallurgy, a new iron powder called Type 6460 has been developed by Republic Steel Corp. Incorporating small quantities of nickel and molybdenum as alloys, this material can be used at tensile strengths developed in heat treating the more common wrought or cast metals.

Performance is comparable with grades of carbon steel normally used in machine parts subject to high stresses, such as automobile transmission gears. Type 6460 may be fabricated to develop minimum tensile strengths of 60,000 psi as sintered and 100,000 psi when heat treated.

Ease of fabrication and good dimensional characteristics suggest that this alloy powder will prove a highly competitive consideration in selecting a manufacturing process for a great many commonly used parts.



bearing life boosted from

THREE WEEKS TO FOUR YEARS

with Texaco Cleartex Oil

Tyson Bearing Corp., Division of SKF Industries, Massillon, Ohio, extended the life of micro-centric grinder bronze sleeve bearings from 3 weeks to 4 years (and they're still going strong) using *one* oil—Texaco Cleartex B—for both grinding *and* machine lubrication.

Before Cleartex was used, machine bearings would fail in about 3 weeks, because the lubricant became contaminated by grinding oil. With Cleartex this problem simply doesn't exist. A premium quality lubricant, Cleartex is *also* a fine grinding oil. In fact, Tyson now gets as many as 20 pieces per wheel dressing, each with a better finish, compared to the 10 or 12 that were previously obtained.

You can do any machining work better, faster and at lower cost with Texaco—a complete line of cutting, grinding and soluble oils. A Texaco Lubrication Engineer will gladly help you select the right ones for your job. Just call the nearest of the more than 2,000 Texaco Distributing Plants in the 48 States, or write: The Texas Company, 135 East 42nd Street, New York 17, N. Y.

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WHAT'S AHEAD... in Metalworking

TRENDS

Schedules will be expanding...

Operations in the metalworking industries are rising very slowly. Indications are that production will go up modestly in the fourth quarter. The main news is that the worst seems definitely over and from here on schedules will be expanding instead of contracting.

Demand for steel and other metals supports this position. No great spurt is expected in steel, but best estimates are that the fourth quarter will average somewhat better than the third quarter. And keep in mind that the third quarter was better than anticipated.

Much depends on what the automobile industry does. Recently auto production has been handicapped by a series of guerrilla strikes. While Detroit is ordering more steel and parts than it did, it is playing it safe by sticking to modest-sized releases. It wants to see what the public reception to 1959 models will be before it plunges into a higher volume of ordering.

Some auto companies have been trying to get by on an inventory of 20 days in hand and in transit, and now are inclined to add five days to this schedule.

Home appliance sales have taken a definite upward trend. They promise to rise further next quarter.

Refrigerators, freezers, built-in ranges and dishwashers have shown the best gains, one manufacturer reports. One of the spurs to better production is the sizable increase in orders from distributors and dealers who let their stocks get down to a very low level.

TV set output is going remarkably well. At least one maker delightedly reports being sold out through November. It declares that its distributors "are crying for merchandise."

Another home appliance company states that production is the problem now, not sales. Home freezers and clothes dryers are best sellers.

Railroad freight car building is gaining here and there. Pullman Standard, for example, is beginning to fill an order for 1000 box cars from the Chicago & Northwestern.

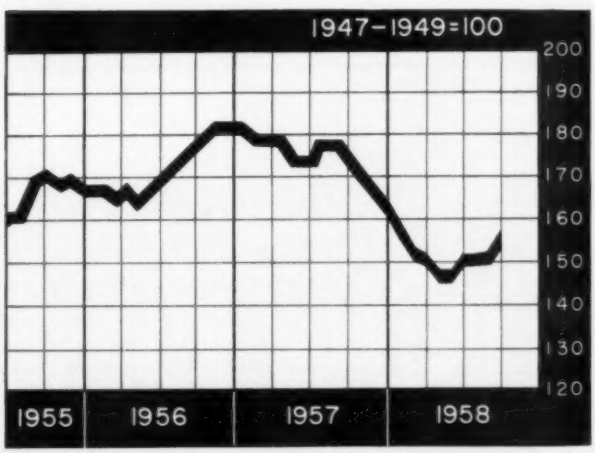
Bookings of material handling equipment have risen the past two months, the Material Handling Institute Inc reports. The dollar volume of new orders is ahead of last year's. Further improvement in sales is anticipated.

Production of gray iron castings has been showing improvement since it started to look up in the second quarter. But it still leaves much to be desired. The total up to now is far below the performance record of last year.

Demand for soil and pressure pipe held up well, whereas business from the industrial machinery and automotive industries has been slow. Sales of ingot molds are expected to be better in the final quarter.

Farm equipment business continues to be strong. The whole industry, in fact, has felt a pickup. The contrast with last year is most favorable.

The upturn in construction machinery began a few months ago. And in the past 30 days a sharp gain has been noticeable. Orders right now are strong for most types. Reason probably is the letting of a lot of contracts on the federal highway program. The lumber industry in the Northwest is said to be coming back to life; this is a source of some construction machinery sales.



AMERICAN MACHINIST INDEX OF METALWORKING PRODUCTION

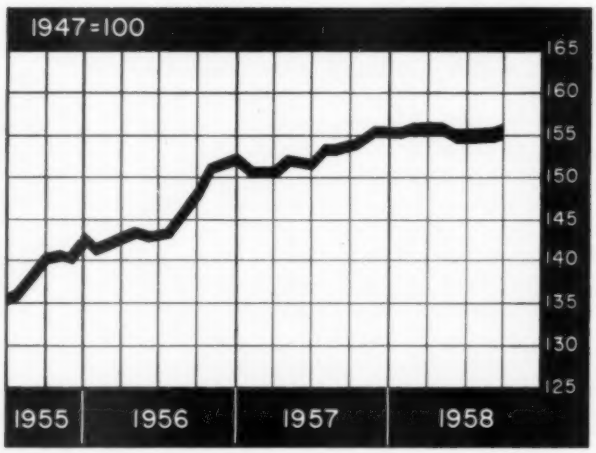
BASED ON MANHOURS WORKED IN THE FIVE COMPONENTS

	SEPT. Estimated	AUG. Preliminary	JULY Revised	AUG. Year Ago
Total Index	**157**	**156**	**154**	**177**
Machinery	128	126	151	
Electrical Machinery	191	181	212	
Autos	74	84	120	
Other Transportation	379	333	370	
Other Metalworking	135	135	147	

TRENDS WHAT'S AHEAD... in Business

AMERICAN MACHINIST INDEX OF METALWORKING PRICES

	SEPT Estimated	AUG Preliminary	JULY Revised	AUG Year Ago
Total Index	**156.1**	**155.9**	**155.8**	**153.4**
Metalworking Machinery		**180.8**	**181.2**	**178.4**
Other Machinery exc. Electrical		**166.2**	**166.0**	**162.7**
Electrical Machinery		**159.0**	**158.9**	**155.7**
Fabricated Metal Products		**146.2**	**146.2**	**144.4**



Industrial output is gaining steadily...

Recovery continues apace. On the output side, industrial production has been advancing steadily since April and now is only about 5% below the peak reached last year. Thus America's factories and mines have made up about 2/3 of the ground lost between 1957's summer high and 1958's spring low.

Soft goods output is actually running ahead of the production volume a year ago. And production of hard goods, though still over 10% below year ago levels, has been gaining steadily since last spring, too. The pickup in durable goods output would have been much more pronounced but for the continued extremely low level of automobile production.

Now, though, with the 1959 models going into large-scale production, car manufacturing will spurt ahead dramatically. This, in turn, will boost production in other key industries. Steel, for example, is expected to increase output about 15% in the final quarter, when Detroit will be placing heavy orders.

On the consumption side, the most recent retail sales figures indicate that Americans are buying very nearly the same volume of goods and services as a year ago. As with production, consumers are spending more than ever on soft goods but about 10% less on durables.

Fast as the recovery is proceeding, however—and it's come a lot sooner and moved a lot more vigorously than most economists thought it would—unemployment remains high. About 2 million more people are out of work today than a year ago.

And because of increased productivity and additions to the labor force, even when gross national product **reaches the 1957 record in real terms,** unemployment will remain above the low levels of the boom years, 1955-1957.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week Index of Activity (1947-1949=100)*	134.3	132.9	143.0
Steel ingot operation (thousands of tons)	1,793	1,771	2,105
Electric power output (million Kilowatt hours)	12,240	12,248	11,991
Production of automobiles and trucks	54,509	32,099	68,875
Engineering construction awards (Eng. News-Record—millions)	$ 370.7	$ 332.4	$ 342.3

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production (1947-1949=100)*	137	134	145
Index of durable manufactures production (1947-1949=100)*	144	141	163
Durable goods manufacturers' sales, millions*	$ 12,534	$ 11,960	$ 14,590
Machinery manufacturers' sales, millions*	$ 3,962	$ 3,772	$ 4,459
Durable goods manufacturers' new orders, millions	$ 12,221	$ 11,486	$ 13,716
Machinery manufacturers' new orders, millions	$ 3,871	$ 3,681	$ 4,512
New Orders for Nonelectrical Machinery (1950=100)*	156	163	146
New Contracts for Industrial Construction (1950=100)*	73	89	140

* Seasonally adjusted

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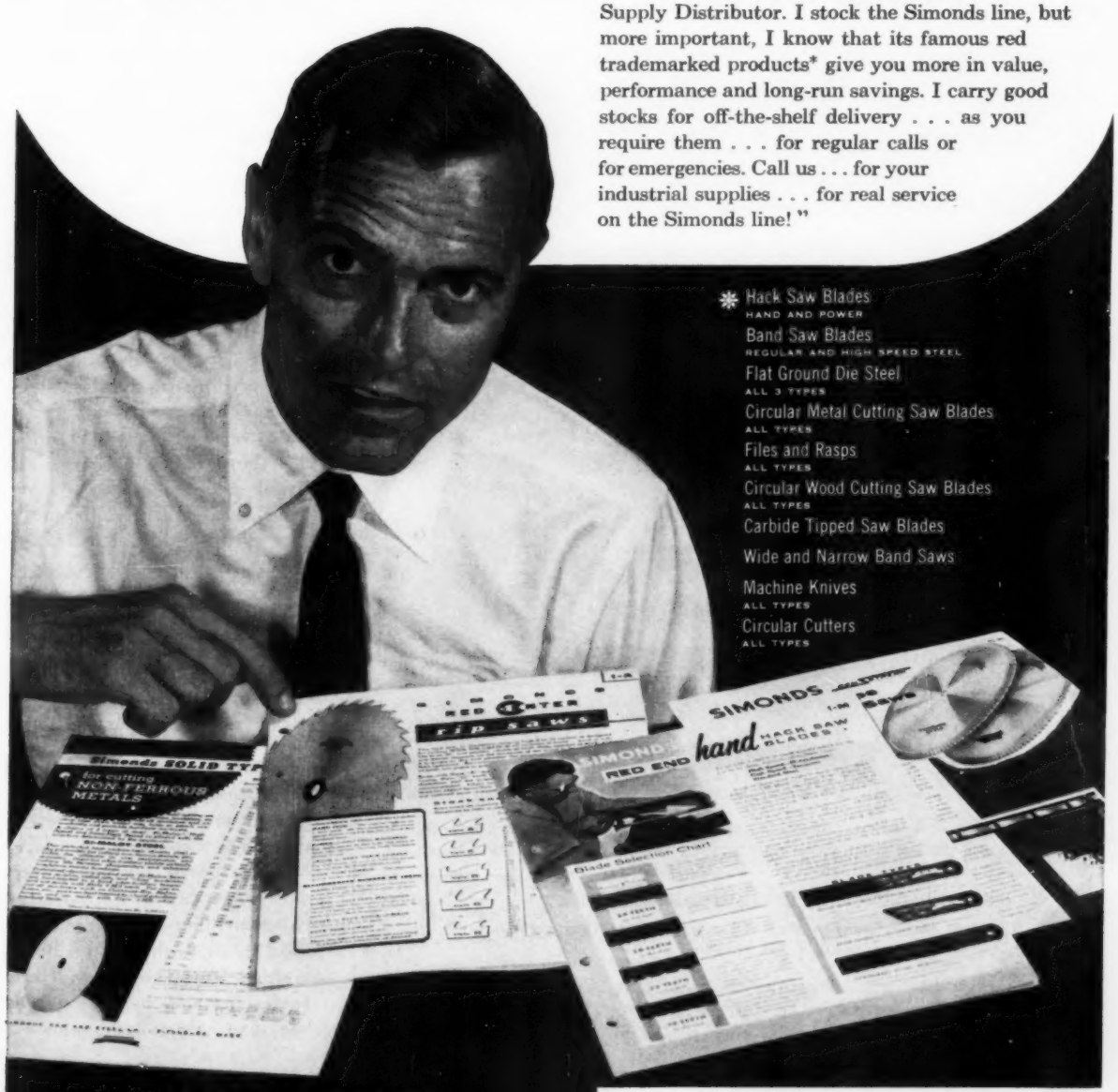

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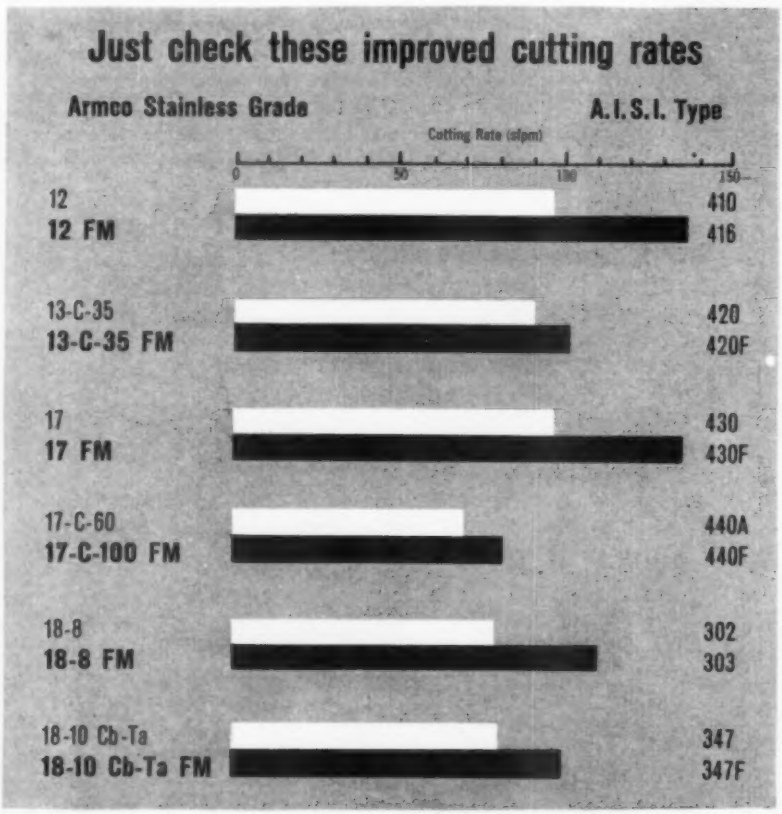
Why production steps up with ARMCO FREE-MACHINING Stainless Steels



Here's the increased machinability you can about expect from some often-used free-machining stainless steels. All rates are based on speeds in automatic screw machines.

In service, the toughness of stainless steels gives them endurance that ordinary metals can't match. But in part-production, this very toughness can limit machining speeds. That's why Armco produces free-machining counterparts for many widely-used grades of stainless steel bar and wire. Small additions of certain elements make these special grades machine faster. Production rates jump.

TRY THEM

Here's how to prove it for yourself. If you now machine parts from a standard stainless steel, just contact your nearest Armco Sales Office or Armco Stainless Distributor. They will be glad to arrange for you to try out the Armco Free-Machining counterpart of the grade you are now using.

Or, if you would like more information about uniform-quality Armco Stainless Steel bar and wire, just fill in and mail the coupon.

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In addition to stainless steel sheet, strip, plate, bar and wire, Armco produces these other steels for top-quality products: ALUMINIZED STEEL, ZINCGRIP®, ZINCGRIP PAINTGRIP®, Cold-Rolled PAINTGRIP, Enameling Iron, Electrical Steels, High Strength Steels, Welded Steel Tubing, and Long Ternes, as well as high-quality hot- and cold-rolled sheets.

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American Machinist
MAGAZINE OF METALWORKING PRODUCTION • ESTABLISHED 1877

To Improve Your Competitive Position

Ford and the United Automobile Workers Union have signed a three-year contract. It is described as non-inflationary.

Yet it calls for continuation year by year of the "annual improvement factor" averaging seven cents an hour. It grants a three-cent-an-hour cost of living adjustment immediately and guarantees such adjustments in the future.

It includes many so-called fringe benefits. Ford employees will be able to collect supplementary unemployment benefits in full for the entire length of the benefit period from now on. Benefits also will go to employees on short work weeks who cannot draw State compensation.

These provisions are only part . . .

of the concessions that the union has exacted from Ford. Others add still more to the labor cost.

Though a Ford spokesman was quoted as saying that the settlement is non-inflationary, he commented in the same breath that he was inclined to think that it would have some effect on the prices of Ford products.

There is no point in trying to soften the harsh facts confronting metalworking management. The union won these terms from Ford at the end of the poorest automobile season in years and prior to any tangible improvement in sales and production.

Other automobile settlements are not likely to be milder than Ford's. Negotiations are coming up in other metalworking industries; and as business gets better, union leaders will not be slow in pushing for more money.

The big steel union is getting set to make sizable demands the middle of next year when its long-term contract expires. Steel production then promises to be better than this year. And it is a sure bet that the union will get at least part of what it wants and that labor rates in the steel industry will go up.

If you have in mind . . .

trying to stop inflation, these observations may be construed as gloomy. But they certainly are realistic. And you will do well to take them into your calculations as you plan ahead.

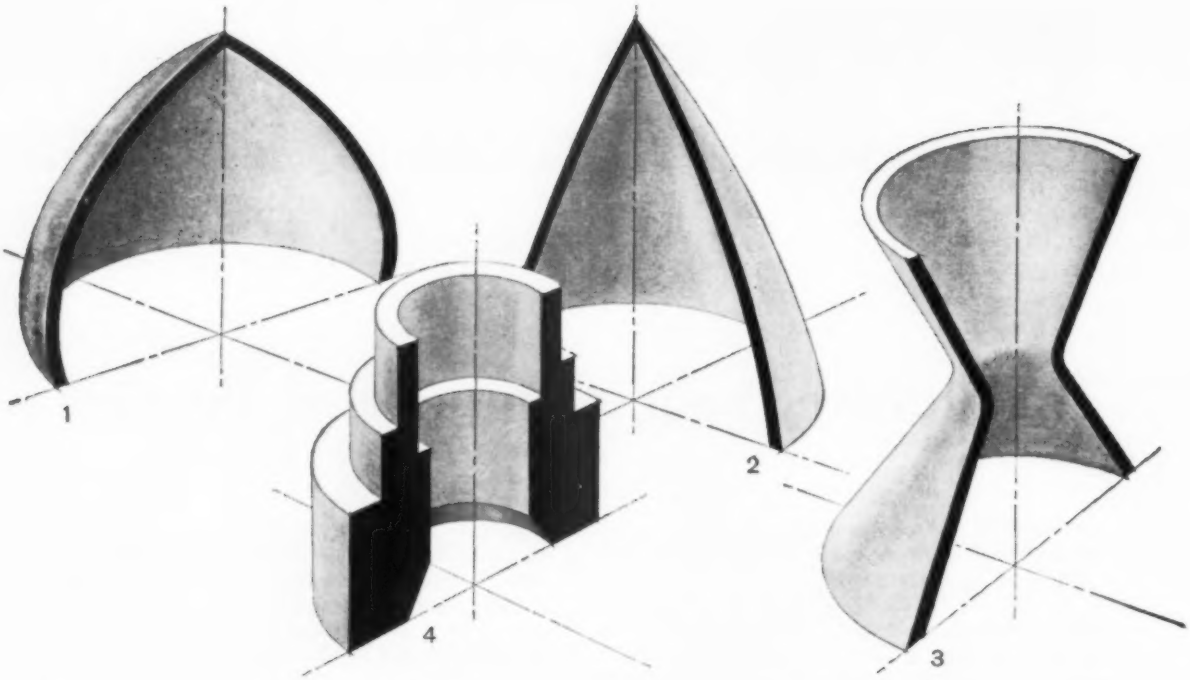
For the truth is that average hourly wage rates in Metalworking, as in all other industries, have been slowly and inexorably mounting through the years. The end is not in sight. Studies of what is likely to happen to our economy the next 15 to 20 years take for granted the fact that the average wage rate is sure to keep going up. And fringe benefits are certain to grow, adding further to the cost per worker per hour.

As this fixed cost . . .

becomes ever higher, only one course is open to you. You must get more production out of every worker. You cannot secure it by any other means than mechanization. Machine power must be substituted for muscle power.

If you will take this course and thereby keep constantly increasing your productivity per man, you will have your best chance, though slight, to hold down inflation. At the same time you will be improving your competitive position and your profit margin.

Burnham Finney EDITOR



how to Vertical Grind missile shapes

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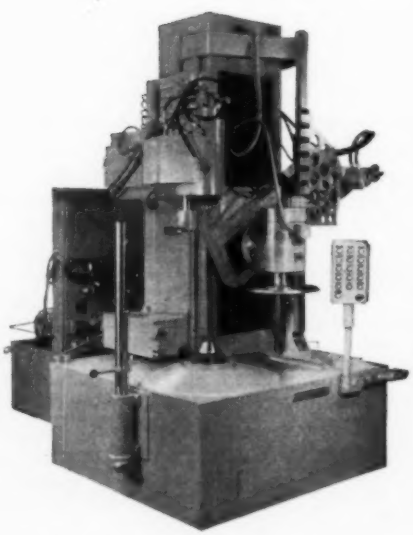


This machine accurately grinds a compound-curve dome. Both the grinding wheel and a single point tool follow a precision template. Automatic parting tools remove excess stock, top and bottom.

THE SPACE AGE—
What's in it for metalworking?

Any impact space flight may have on industry will be indirect, but its effects on research and development, on new materials and new techniques will be well nigh incalculable

What will man's conquest of space mean in terms of down-to-earth metalworking? For one thing, very little in the way of mass production—emphasis will be on quality rather than quantity, and any impact space flight may have on metalworking will be in the form of accelerated research and development of materials and processes, and increased demands for reliability.

That is the consensus of America's top military and civilian scientists, who more or less agree that space flight is at least 20 years away (they're not talking about the current ICBM and IRBM missile programs), and that a moon base will have to be established before man can take off into space.

These opinions were advanced by a panel of experts at American Rocket Society's Fall Meeting late last month in Detroit.

Said Brigadier General Homer Boushey, first Director of Advanced Technology, U S Air Force: "Space travel is man's most important venture—and a vital need for the military."

New metals, new alloys

Such by-products of space flight as the development of new metals and alloys will find wide application in industry, he said, as will solar power, which may possibly be a main source of power for manned satellites and rocket ships. Too, the reliability standards set up for space flight will carry over into other fields. They will probably result in development of better machines, new testing equipment and other devices applicable to many segments of metalworking.

The drive for space flight will result in new means of transportation and propulsion, according to Major General John B Medaris, Chief, Army Ordnance Missile Command. "Any means of transportation that is faster has always been exploited by man," he said. "The talk of missile transportation from place to place on earth is not a dream."

Dr George E Valley, chief scientist, USAF, said, "As I see it, industry will profit most from the indirect results of space research. This research will very likely result in discoveries applicable in areas other than space flight itself."

Dr Valley added that Congress has set up new agencies to speed research in the space age, to increase emphasis on civilian direction of research and development, and to liberalize procedures for the support of basic research. "One would have expected some increase in the research and development budgets to accompany these programs, but there has in fact been no significant increase." He added that in some areas Congress has reduced funds for science and space research.

Fewer missiles with greater reliability will be the key to space flight, according to Dr Valley. A possible exception in the direction of volume production may be quantities of second- and third-stage booster rockets. He pointed out the possibility of standard sizes of such boosters for use with a variety of space missiles.

Willis Hawkins, general manager of Lockheed Missile Systems Division, suggested that space flight's biggest impact on industry would be in personnel requirements—especially in research and development.

A broad spectrum of different talents will be needed—along with a wide variety of types within these different specialties. At Lockheed, he said, there are 44 different kinds of specialists engaged in missile work. For space programs this would be increased to around 66. He also pointed out that 19% of Lockheed's technicians are now working on missile programs. About 43% of all technicians would be needed for space work.

The profit picture, too, he pointed out, will be quite different. There will be no long production runs in which to compensate for errors.

This point of view was emphasized by K J Bossart, assistant to the vice president, engineering, Convair, who also added that capital investments per dollar produced will be far above what we experience now.

Other members of the panel were John DeNike, astronautics project manager for the Martin Co. and Richard Cesaro of the Advanced Research Projects Agency.

In addition to this panel discussion, eight technical sessions were held at which 29 papers were read. Among the topics covered were long and short range missiles, latest developments in monopropellants, operational service systems, and production methods for missiles.

Building Redstone, Jupiter

John S Sheldon of Chrysler Corp's Missile Division described riveting, welding, machining, forming, and assembly techniques employed in building of the Redstone and Jupiter missiles.

A similar paper on Redstone and Jupiter guidance and control components was given by John Young Jr of Ford Instrument Co. Extreme accuracy requirements, he said, necessitate exceptional cleanliness in this work.

A description of the Redstone power plant and its manufacture, testing, and assembly was given by

W R Studhalter, program manager of Rocketdyne Division of North American Aviation Inc. Mr Studhalter emphasized the need for flexibility of production because of the frequency of design changes. He also cited the problems of procurement and program coordination in maintaining production schedules when about 50% of the engine components are manufactured outside the firm.

J W Albright of Chrysler Corp's Missile Division, discussing fabrication of missile system electrical components, said reliability involved is far greater than anything ever before encountered in industry.

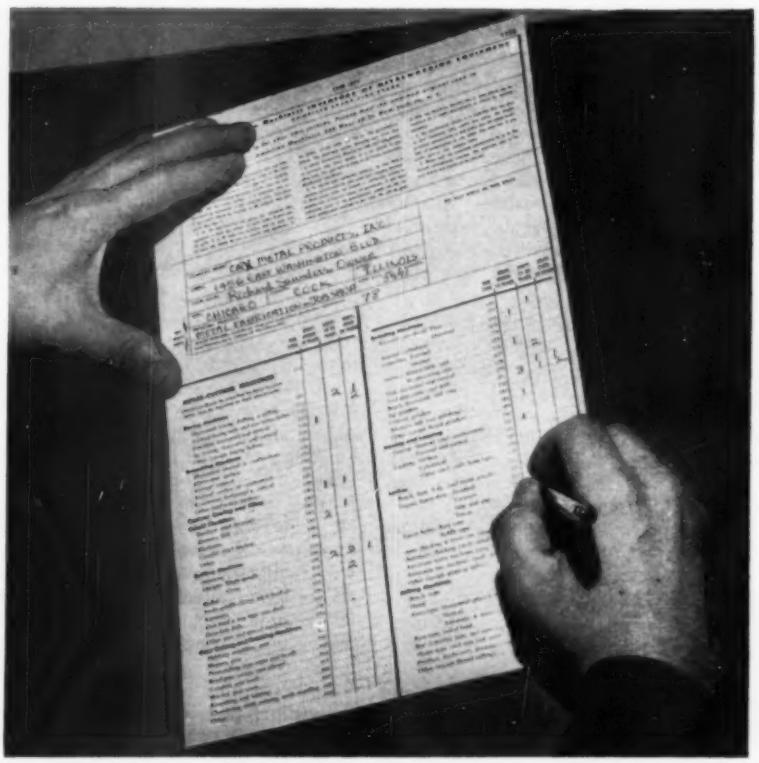
Other papers on production techniques included one on manufacturing integral electronics in small missiles by G E Sylvester, chief engineer, product engineering, Convair. D M Rush, manager of production control, Raytheon Mfg Co, spoke on effective control of change orders and missile production, and Donald K Meikle, head, Missile Final Acceptance Testing, Chrysler Corp Missile Division, discussed missile systems acceptance inspection.

AM's Eighth Inventory nears completion

The most comprehensive state-of-the-industry report on metalworking ever published will be out in less than six weeks—AMERICAN MACHINIST's Eighth Inventory of Metalworking Equipment.

Based on survey replies from upwards of 5800 metalworking plants, the new Inventory, the first to be published since 1953, is U S metalworking's "Yardstick of Obsolescence." It will give the age (less than 10 years old, 10 to 20 years old, or more than 20 years old) of 167 types of metal-cutting, metal-forming, welding, heating, cleaning, finishing and other shop equipment—breaking these totals down into 16 basic industry groups and 24 geographical areas.

Using the inventory as a yardstick, management of a given plant can compare its equipment with that of its competitor or fringe-competitor industries, or even with non-competing plants in the same geographical area.



How industry will use it

Take, for instance, the way in which one of America's largest companies plans to use the Inventory in its modernization program:

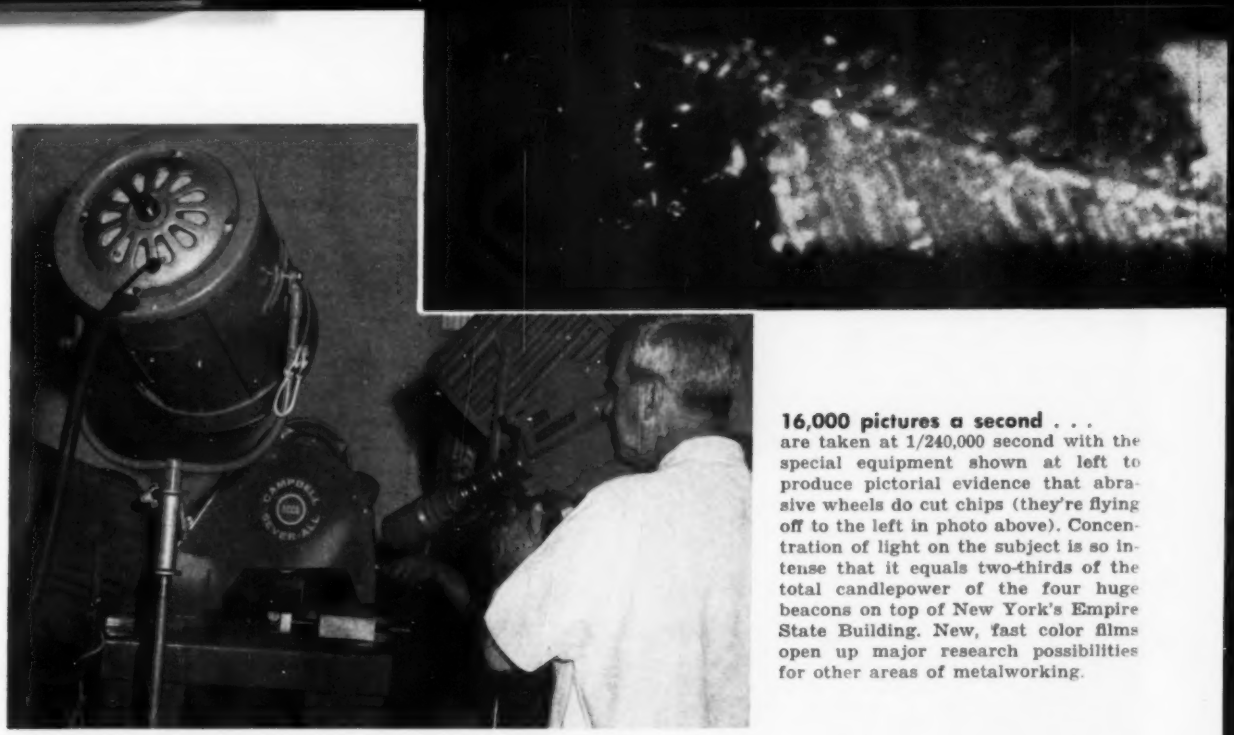
Each of this firm's many plants filled out and returned the Inventory questionnaire some time ago, listing its metalworking equipment. When the Inventory is published on November 19, the company's home office will send a copy of it to each plant with instructions to compare the plant's equipment with that of other firms in the same industry as to type and age of equipment. In this way, the company expects to get a much clearer picture of its manufacturing capabilities in relation to its competitors.

The Inventory, as it has in the past, will be used in many other ways, too—by the government as a measure of U S defense capacity, by industry in making its long-range modernization and expansion plans, by trade and technical associations, by marketing groups, by regional industrial organizations, by economists, colleges and universities and many others. For the AMERICAN MACHINIST Inventory is unique in the width of its scope and the depth of its research, and the forthcoming Eighth Inventory is the most exhaustive study of U S metalworking capacity ever made.

More than 23,800 questionnaires were mailed out early in March to metalworking plants throughout the country, requesting information on the number of machine tools and other metalworking equipment by type in each plant, and the age group of the machines.

Replies from more than 5800 plants (far surpassing 1953's then-record Inventory of 3900 plants) have since been processed by the magazine's editorial staff in something like 5000 man hours of work, then turned over to data-processing machines.

At least 1350 machine hours have since gone into key-punching more than 200,000 IBM cards, together with sorting, calculating and tabulating operations.



16,000 pictures a second . . . are taken at 1/240,000 second with the special equipment shown at left to produce pictorial evidence that abrasive wheels do cut chips (they're flying off to the left in photo above). Concentration of light on the subject is so intense that it equals two-thirds of the total candlepower of the four huge beacons on top of New York's Empire State Building. New, fast color films open up major research possibilities for other areas of metalworking.

Film proves abrasive wheels cut chips

Indications have existed for some time that abrasive cutting is a discontinuous process. Now, close study of the cutting action of abrasive wheels, using movies taken at 1/240,000 second and 16,000 pictures per second, has not only proved the theory but has produced a variety of other valuable information.

Through the ingenuity of scientists and engineers at the laboratories of the Allison-Campbell Div of American Chain & Cable Co, with the help of Weber-Reed Films, Inc, a significant series of color motion pictures has been recorded. Filmed sequences clearly show that cutting *is* discontinuous and that there is a wide area in which to improve cutting efficiency.

Vibration appears to be one of the major reasons for this interrupted cutting action. Another cause is random distribution of the particles which make up the wheel—abrasive material, bonding agent, etc. Seemingly consistent, the wheels apparently contain minute clusters of these materials which have a varying cutting effect, hence cause uneven breakdown of the wheel.

Until now, many metallurgists and machinery manufacturers believed that the minute particles obtained in dry abrasive cutting, and observed under the microscope as solidified globules of metal, had been in a molten or near-molten condition as they became separated from the material being cut. Practically instantaneous pictures of the cutting action show this idea to be nothing more than a half truth.

Titanium is molten as it leaves the wheel. **Steel leaves the wheel as real chips, some ¼ to ½ in. long, which then rapidly oxidize in the air and appear to melt into globules from their own heat of burning.** Before this, the nice, clear chips look like they have been milled.

Ti doesn't dissolve wheels

Titanium, quite obviously, is not *dissolving* cutting wheels as some people have thought. Instead, it seems that the molten globules are causing more rapid breakdown of the wheel by fusing to it and breaking off pieces—just as fusion breaks down the edge of a cutting tool.

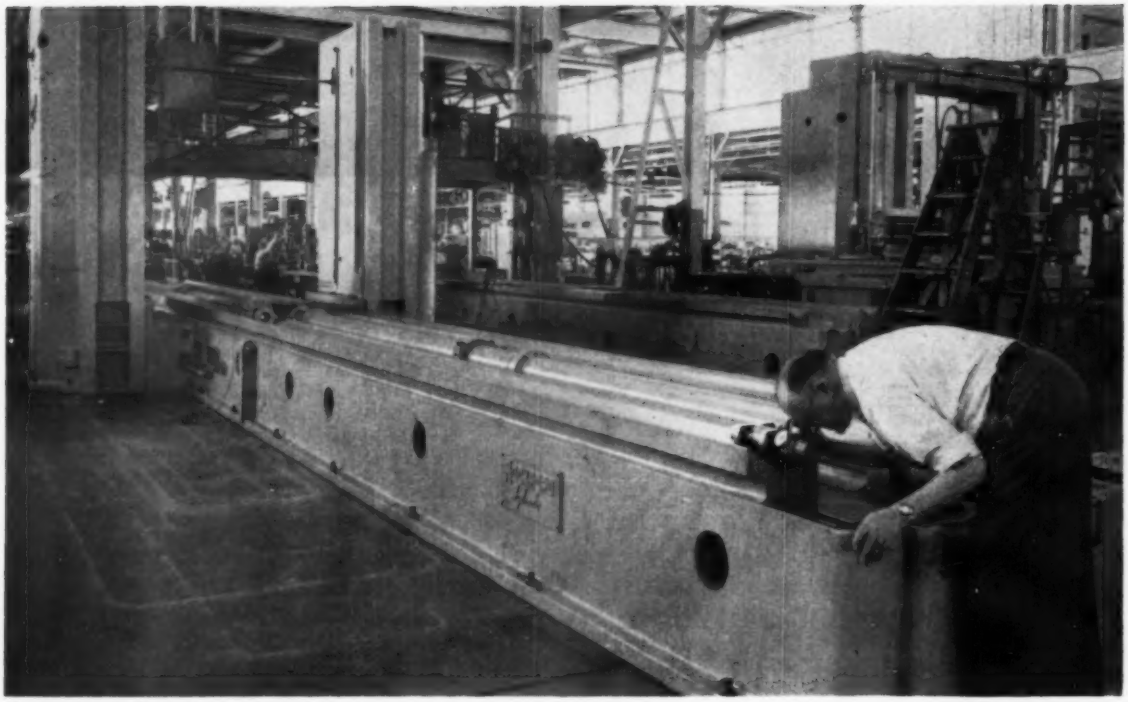
How will this research affect the design of abrasive-cutting machines and wheels? Hugh Allison, General Manager of the Allison-Campbell Div; has a slew of ideas. **Machines must be designed to minimize vibration far more effectively than is now possible.** Research will extend, too, to vibration neutralizing and dampening techniques.

Wheels will come in for some major changes, will be designed for more specific applications and material conditions. Both the ingredients and the mechanical structure will be controlled more closely to suit the specific job. New ingredients, such as lubricants, might be added to the wheel composition.

Materials used for these tests were SAE 1020 steel and pure titanium. Wheel was rotated at about 6000 sfpm and, of course, cutting was dry. Titanium showed a peculiar condition in that tiny globules of a gaseous material, having a fractional-second life, were given off during cutting. The difference in the character of the "chips" resulting from the two materials may be heavily influenced by the difference in heat conductivity.

To get a better definition of the true cutting action, using a film travel speed of 16,000 frames per second and Super Anscochrome color film, exposures were made with a special slit-aperture plate giving a 0.010-in. lens opening in a special camera developed by the Fastax Div, Wollensak Optical Co. The 100-ft rolls of film, exposed at 1/240,000 sec per frame were used up in 7/10 sec each. Light, 800,000 candlepower strong, concentrated in a 3-in. circle, came from a 7.5-kw Zenon lamp pulsed for a 2-sec-light-duration period.

Results so far have just whetted the appetites of the researchers. They anticipate further study in other metals and materials—when they can find a faster and sharper photographic technique.



Alignment of planer ways . . .
on this heavy-duty, double-housing hydraulic planer is easily performed, with an alignment telescope and target, to 0.0007 in. over a distance of 54 ft

Optical line of sight establishes planer precision

Fixtures built in our shop . . .
contain the telescope and target with alluminator for checking V-ways of planer bed. Parts have lapped, wring fits

By P B Newton, chief inspector
Rockford Machine Tool Co, Rockford, Ill

A stretched wire won't serve for a datum, when you must align 54-ft. ways so that planing to 0.001 in. can be achieved

Our experience has proved that optical tooling does certain alignment jobs that we cannot do accurately in any other way. For example, in the construction of our very large, heavy-duty, double-housing hydraulic planers, we run into a serious problem of aligning the ways for the bed. In the machine shown the 54-ft ways are supported by two castings bolted in the middle. A misalignment of as little as 0.0005 in. at the bolted joint can result in serious misalignment at the ends of the ways.

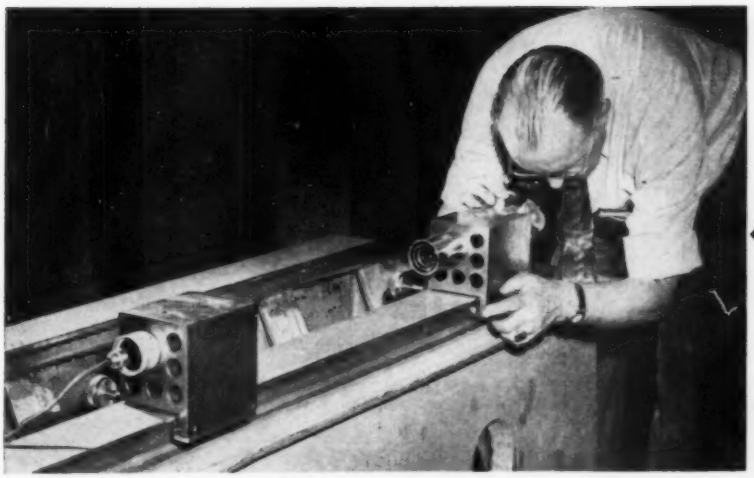
Before the adoption of optical tooling, we were forced to use the conventional method of stretching a wire, which is straight only at the instant before it breaks. If you can do your measuring in that split second, fine; otherwise, you have sag.

Now, with our Micro-Alignment telescope and target held in simple fixtures made in our own shop, we can establish the line of sight or datum straight line directly with the telescope mounted on the way. Our optical tooling was furnished by the Engis Equipment Co.

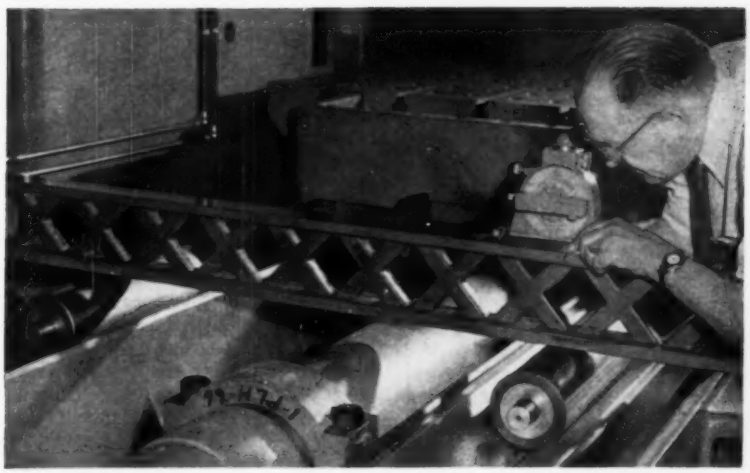
Two Readings at Once

With this setup, we can get readings in two directions: up-and-down and left-and-right. Thus, we can check straightness or flatness both longitudinally and from side to side in one operation.

Normally, we take about 10 read-



Additional fixtures . . .
are used to hold the alignment telescope and target with illuminator for checking straightness and parallelism of ways on open-side planers. A cylindrical pin holds fixture in alignment tangentially to the V of the way, while a pad and screw clamp bear against the interior vertical face of the way



Levelness of ways and bed . . .
is established with a Microptic Precision Clinometer. During original construction only a datum level is established. When the machines are erected in the customer's plant, true level may be determined with the direct-reading Clinometer to better than 10 sec, by means of its optical micrometer

With datum established . . .
the verticals of the columns are checked with relationship to the level of bed and and ways. Verticals and parallelism of columns can be held to within 0.001 in.

ings on each V-way. We set the telescope at one end of the way and the target at the extreme far end to take our first reading. This establishes our datum line of sight. The datum is then divided into a series of intermediate stations, and the target is moved toward the telescope while successive readings are taken. From these readings, we plot exactly the deviation along the way. Alignment over the 54-ft bed is held to 0.0007 in. or better, while parallelism of ramways, crossways, and columns is held to within 0.001 in.

The TTH-Engis Micro-Alignment telescope focuses on the target at any distance from directly in front of the telescope to infinity. The two optional micrometers for vertical and horizontal adjustment have a range of ± 0.050 in., and can be read directly to 0.0002 in. Magnification of the image seen in the eyepiece is independent of the distance to which the instrument is focused. Also the eyepiece shows a vertical or lateral "picture" exactly as it exists. When there is a left lateral displacement of a thousandth, it shows as a left displacement in the eyepiece.

Another tool which we are using in conjunction with optical tooling is the Microptic Precision Clinometer. This device has a built-in optical micrometer and direct-reading system. We are using the instrument to level our machines and check machine columns for true vertical with reference.

In constructing planers, we first establish a datum level for the ways and bed and then work from that with the Clinometer to check the accuracy of the column verticals. The ability to read directly to better than 10 sec means that we can hold verticals and parallelism easily to within 0.001 in.

One advantage of these optical instruments is that they are self-checking. This means that the man in the shop can check the accuracy of the instrument he is using directly and while he is using it.

Our field erecting crews use a second set of optical instruments.

Long, complex shapes . . .
. . . such as the cross member (top, in red), and side rail (above) for the new K-frame of the 1959 Buick can be welded automatically at about 100 pcs/hr. Boxed-in design of the side rails and cross members is considerably stronger than 1958's half-channels

Contour welding with a tape-controlled tracer . . .

. . . has at long last licked one of the auto industry's toughest problems, high-volume production welding of long, corkscrew-like frame members

By George H De Groat, Detroit editor

Long a headache in the automotive industry, the difficulty of welding long (up to 12 ft) twisting automobile side rails, and cross members, has been overcome by three-machine tracer-controlled contour welding at Midland Ross, Cleveland.

Trickily shaped side rails for the 1959 Buick's new K-frame are made up of two channel halves welded together to form a boxed-in construction. Somewhat-shorter cross members are also made of channel halves for greater strength.

Big problem with both side rails and cross members, insofar as automatic welding is concerned, lies in the wide dimensional variations between weld-line contours as specified on a print, and actual contour of the channel halves. In many instances, these variations are not consistent even from part to part—and they may be as much as 3/16 in. above or below blueprint size.

This eliminates use of automatic welding machines that are entirely cam controlled for following a contour, because the cams would have to be made to print dimensions, or to some mean average. And if the part to be welded varies from print dimensions, the weld would be made in the wrong place.

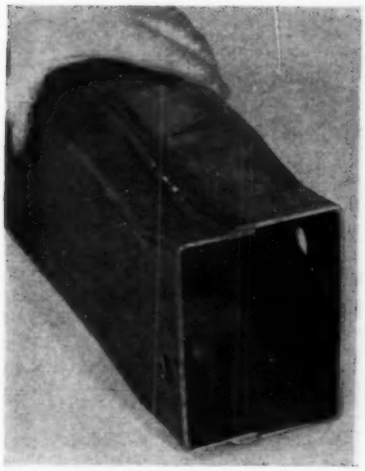
Midland Ross's three-machine setup, made by Detroit's Expert Welding Machine Co, has one machine for automatic welding of left-hand side rails, a second for right-hand side rails, and a third for welding of side members.

A mechanical probe in the automatic tracer unit accurately locates the weld line by recording its variance from print dimensions on a magnetic line on a tape. As the line is "read," a servo unit positions the welding gun, compensating automatically for variations up to ¼ in. above or below print dimensions—while welding at a rate of 156 ipm.

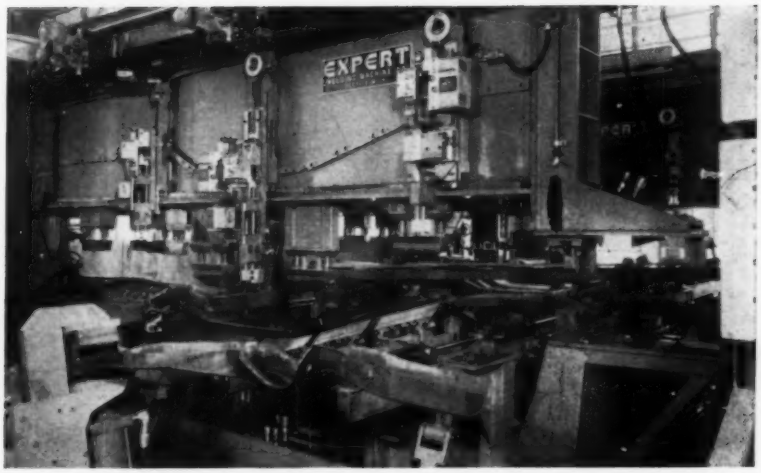
The tracer system corrects only the errors between design and actual contour. This is accomplished with cams that permit the welding head carriage to follow the design contour of the weld line. The mechanical probe is mounted on a slide in this carriage to follow the *actual* weld contour. Incidentally, the probe is positioned several inches ahead of the welding head to avoid being deposited with weld splatter. The distance between probe and welding head is equivalent in time units to the distance between recording and reading heads. This time delay between the signal from probe to welding is about ½ to 1 sec.

A cam follower on a second slide mounted on the welding head carriage follows the design contour cam. The movements of the two slides, (one following the design contour and the other, with the probe, following actual contours) provide a differential whose output represents the error between the design and the actual contour. This displacement error is recorded on a loop of magnetic tape where it is stored temporarily.

The reading head (located on the same tape loop several inches behind the recording head) picks up this error intelligence and feeds it through a simple amplifier and hy-



Automatic welding . . .
. . . of cross members is essentially the same as that for side rails, except that only two heads are required on each side of the work



Walking beam transfer mechanism . . .
. . . carries side rails from pre-assembly stations to main welding heads, from there to unload position. Side rails are transferred through the machine in a direction perpendicular to their longitudinal axis

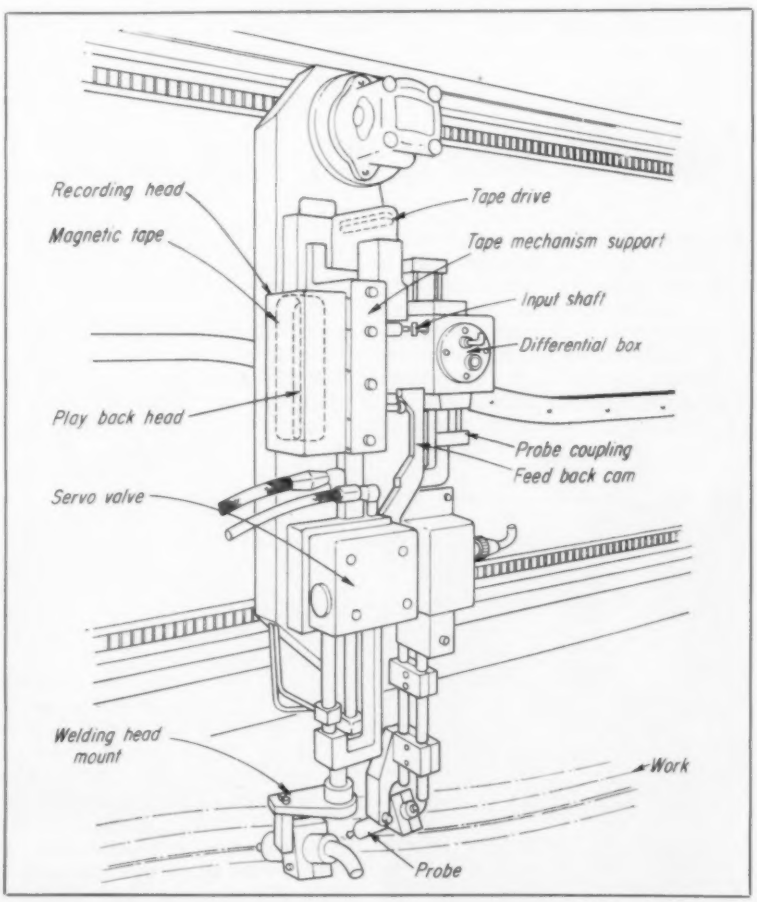
draulic valve to a hydraulic servo cylinder. The servo cylinder then corrects the position of the welding head with respect to the welding carriage. An erase head behind the reading head removes the signal after it has been used.

The loop of magnetic tape eliminates rewinding, and the tape will handle thousands of operations before replacement is required.

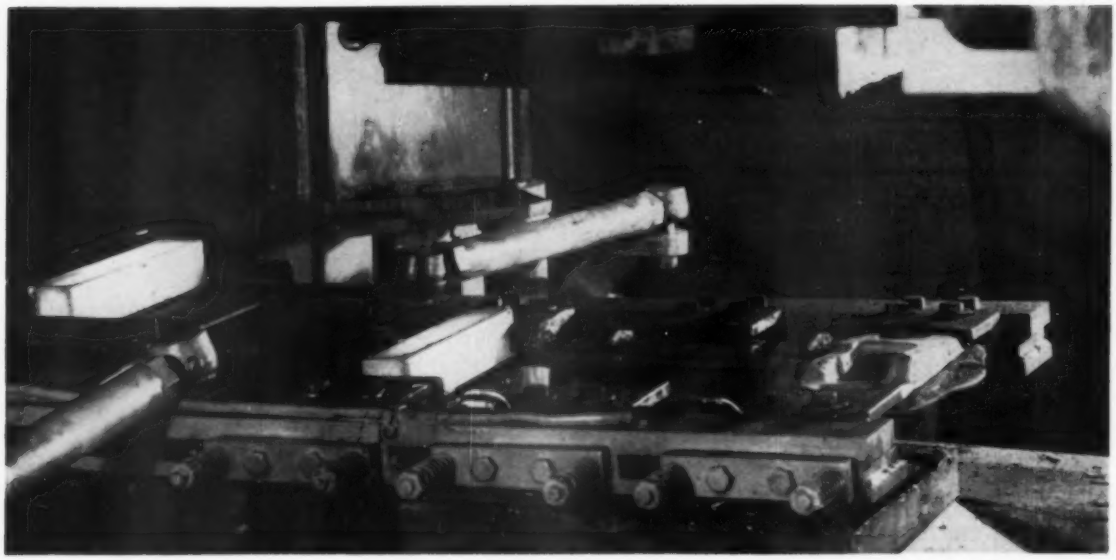
To start the operation, two 120 ft long channel halves (for side rails) are manually loaded into an assembly and tack-welding station at the front of the machine. Here, the channel halves are press-assembled with air clamps. An assembled side rail is automatically transferred to the welding station where the work-holding platen secures it with a group of air-operated clamps, which provide continuous pressure below the weld line along the entire length of the part and compensate for springback after welding.

Vertical movement of the platen, to bring the work up to the welding heads and pressure pads, is accomplished with a self-locking parallelogram toggle linkage. Pressure pads provide the necessary force to insure complete assembly of the two channel halves.

With the platen up and the side rails clamped in position, six welding heads (three on each side of the part) automatically and continuous-up contour weld the sections together. After the welding cycle, the clamps are automatically released and the platen is lowered to permit the next transfer.



Three automatic welding heads . . .
. . . in the Expert machines at Midland Ross are employed on each side of a side rail, cutting weld time and achieving maximum production rates. Although CO_2 is used with this arc welding process, basic tracer system can be applied to submerged-melt arc welding, other methods



Horizontal arms operated from outside . . . are key to automation of hot parts through forging press. Only two ball joints located in bed area are exposed to heat of hot blanks. Bar at left is about to drop from conveyor. Bar in center is in pick-up station ready to move to first die. Piece at right has been finish forged

Automatic handling may triple forging rates

Automatic handling of work through a forging press is possible with a 2500-ton automated press operating at 40 strokes a minute. The handling equipment to move blanks at forging temperatures on a continuous basis was developed by Robert Sanford at Erie Foundry Co and is applied to the mechanical forging press introduced early this year by Erie (*AM*—Mar 10 '58, p160).

Automated forging press . . . has chain for cam controls that operate transfer mechanism. Press is standard 2500-ton model

Operating experimentally on track links for crawler tractors, the equipment demonstrates an ability to triple production over a forging press operating normally. Comparative output on this link:

- 275 per hour on a hammer with a 3-man crew.
- 350 per hour on a press with a 3-man crew.
- 1000 per hour on the automated press with one attendant.

Three stations are required to handle the 4x10 in. track link: 1, pick up the part; 2, semi-forge; 3, finish forge. A fourth station for trimming could be added.

A chain drive from the eccentric shaft of the press drives a special camshaft added to the left side of the press. This camshaft generates the mechanical motions that operate the grip and transfer movements of the horizontal arms. Because the hot forging stock is at temperatures of 2000 to 2400 F and the die area is filled with scale, unusual problems are encountered.

Reliability was obtained by designing the transfer mechanism so that all moving parts are outside the working area except two ball joints on the side linkages. The grip fingers that pick up the work are split on the ends to grip the work above and below the flash. They are spring mounted so that positive gripping action on the blank is assured.

Theoretically, one complete part could be forged at each stroke of the press, but such high-speed operation would overheat the dies. Normally, stock will be fed on every other press stroke, giving a production rate of 20 parts per minute.

The automatic fixture can be adapted to handle different parts by changing the grip fingers on the horizontal arms. To change the amount of travel of the arms requires a new set of cams, so normally the travel is initially set for the largest piece to be handled. Smaller parts can then be handled by spacing the dies to suit this travel.

Early this year, the 2500-ton mechanical forging press, which has now been automated, was introduced. Plans are to extend the range in both directions and offer presses with tonnages from 1000 to 8000.

The 2500-ton press is suited for volume forging of such parts as connecting rods, gear blanks, automotive and tractor valves, stem pinions, ring gears, **track links, and hubs.**

Defense contracting's dark horses

Only a few years ago, it was easy to guess who were the big guns in the business of supplying hard goods for Uncle Sam. They were the automakers (apt to be making anything from tanks to guns to airplanes) and the airframe makers (because orders for military airplanes were so huge).

There's a different story now. Some of the big names of yesterday are on top today, but you're also seeing a lot of companies snaring hundreds of millions in contracts—as in the Pentagon's latest compilation of defense contractors—who were mere hangers-on only a few years ago.

Among the new names getting a bigger slug of last year's contract awards: AT & T, IBM, General Dynamics, Sperry-Rand—to go along with such as General Electric, Boeing, Douglas, and General Motors.

The new giants in the munitions business show up prominently because they are hip-deep in rockets, missiles, electronics, and other atomic-space age weaponry.

Lots of reasons are behind the switches. But mainly they come right down to how successfully company managements have anticipated the trend in military requirements.

Records show that the best way is to get a foothold in the missile and electronic business. The future in defense production lies in contracts for rockets, electronics, and other nuclear-space age hardware; no longer is there as much of a potential in airframes, tanks, and other conventional equipment.

In 1957, for instance, General Dynamics Corp, maker of a wide variety of new-fangled armament, ranging from atomic submarines to ballistic missiles and supersonic aircraft, tops the list. General Electric Co, the second-largest, produces missile guidance systems, radars, jet engines, and other defense hardware.

Broad diversification helps

The roster is studded with the names of corporate giants who have branched out into virgin industrial territory—by setting up new subsidiaries, buying up small independent firms, or by expanding operations of their existing divisions.

General Motors, for instance, has offset the fall-off in business for military hardware standbys like tanks and guns by going into electronics.

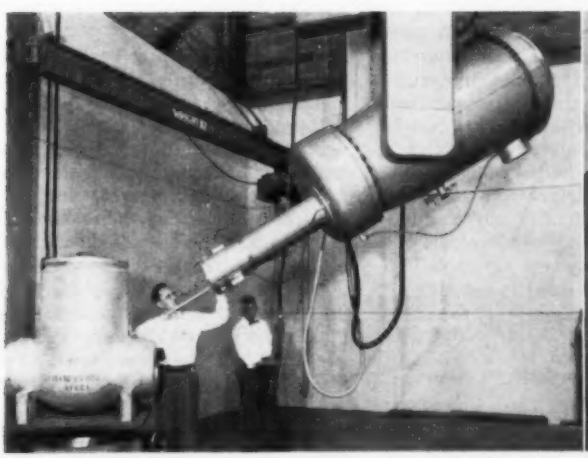
It now makes the guidance system for the Air Force's Thor IRBM, bombing-navigation computers, gun-bomb-rocket sights, instruments, controls, and a wide range of radar and missile components, As a result, the company, which was in 14th place, is back up to 10th. GM is now bidding on missile system contracts, and may rise even higher as a current producer.

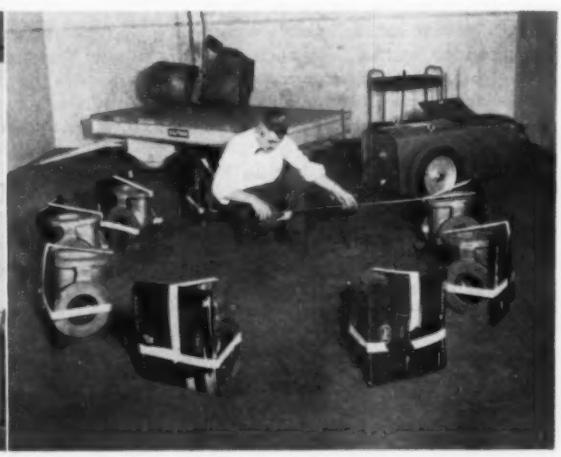
General Tire & Rubber Co has leaped in government activity, the result of expanded defense activity by its postwar acquisition, Aerojet-General. The latter is a leading rocket producer, makes engines for the Titan, Polaris, Hawk, Corvus, Genie and Sparrow missiles.

Chrysler Corp's defense rating dropped after Korea, when tank and other conventional ordnance orders fell off. Now Chrysler is up to 24th place on the strength of new orders for the Jupiter IRBM.

Old-line airframe makers such as North American Aviation, Chance Vought, Martin, Lockheed, Northrop, and Douglas keep their high rank in military production because they became missile manufacturers, rather than relying on planes alone. Even Boeing, while still dependent on aircraft production, owes much of its order backlog to Bomarc missiles.

X-ray, Cobalt 60 team up to test small, large castings



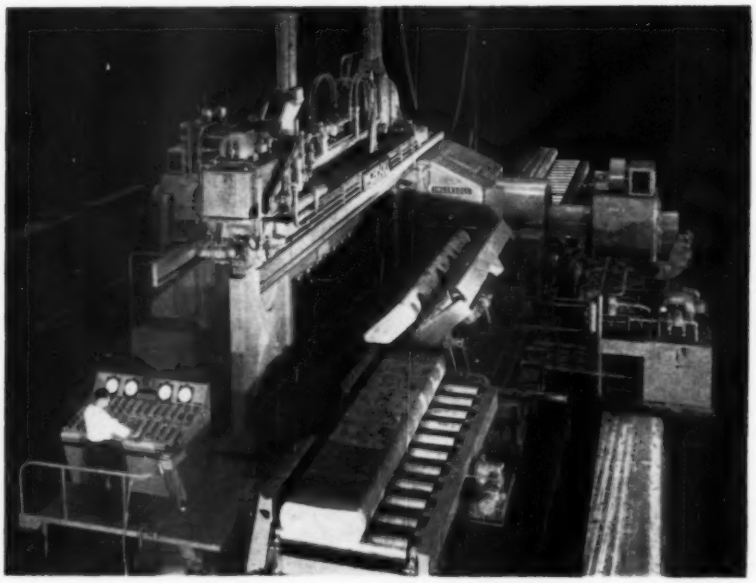


Two-million electron volts of x-ray power and a 10-curie source of gamma radiation (Cobalt 60) have multiplied radiographic-inspection capacity by 8 or 9 times at the Reading, Penna, plant of American Chain & Cable Co, Inc. This combination, believed to be one of the first in industry, permits much shorter exposure times.

Large castings that must be "shot" from a number of different angles are handled by the big Van de Graaff X-ray generator (left), built by High Voltage Engineering Corp. The 4500-lb casting above has 7-in. walls and requires 20 film exposures, but the average exposure is only 1 minute.

Smaller parts such as thin-walled castings and weldments are lined up for "group pictures" around the pellet of Cobalt 60 (shielded, right, in its lead container). The cobalt works more slowly than x-ray unit, but its radiation goes out in all directions so that a large number of parts can be inspected simultaneously

Five machines such as this huge Ingersoll-built duplex scalper—operating two shifts a day, five days a week—could keep up with America's entire aluminum billet output today as . . .



Billet scalping takes a giant step

A machine that deals in millions—it costs a million dollars, and it can process two-million pounds of aluminum in a single eight-hour shift—is headed for Reynolds Metals Co's McCook, Ill, plant.

Biggest, most powerful, most productive duplex aluminum scalper ever built by Ingersoll Milling Machine Co, Rockford, Ill, the new machine could mill both faces of aluminum ingots measuring up to 204 in. long, 6 ft wide and 2 ft thick, weighing as much as 25,000 lb each, even though no one today can cast an ingot of such size. Designed by Ingersoll for high production of large ingots, the machine has 84-in.-dia Ingelsoll Shear Clear carbide face milling cutters, pulls 2800 hp at maximum stock conditions and highest feed rates. Cutting speed is 15,000 sfpm to eliminate need for coolant, and when an ingot is cut, uncompacted chips of softer alloys come from the machine at a rate of 700 bushels per minute.

Ingots are brought to and leave the machine on powered roller conveyors. As ingot rolls onto an upending unit in front of the fixture, the fully automatic operating cycle begins.

Ingot is loaded into the fixture, is centered and clamped hydraulically, fed through the cutters, and unloaded at machine's other end. Process continues automatically at a production rate of 30 ingots per hour.

Machine will continue to cycle indefinitely under normal conditions, or all motions of the machine and handling equipment can be controlled individually from the operator's stations. Fixture rails, carrying the clamping cylinders, as well as the cutting heads and cutters, are adjustable by pushbutton controls to varying widths and thicknesses of ingots.

Elaborate safety precautions

Control system has elaborate precautions for accident prevention or misuse of the machine: hydraulic accumulators maintain pressure on fixture clamps in the event of power failure; mechanically activated clutch and spring-operated brake disconnect the table drive from the feed motor and arrest table motion independently of electric control if the table travels beyond limit switch end stops; and a fixed interlock prevents machine operation if the ingot is not clamped.

Accident-proof operation

Cycle stops if finished ingots are not removed from the conveyor in time; a positive stop prevents adjusting the cutter in the fixture; and an interlock prevents starting of spindle drives motor if jog motors (used while changing cutter blades) are engaged.

If spindle bearing temperature exceeds a preset limit, a red warning light on the head goes on. And table feed rate is lowered or raised automatically when the load on drive motors exceeds or drops below a preset limit.

To quote one Ingersoll official, "It's taken us 50 years of building special machines, and 25 years of building aluminum scalpers to get us ready for this job."

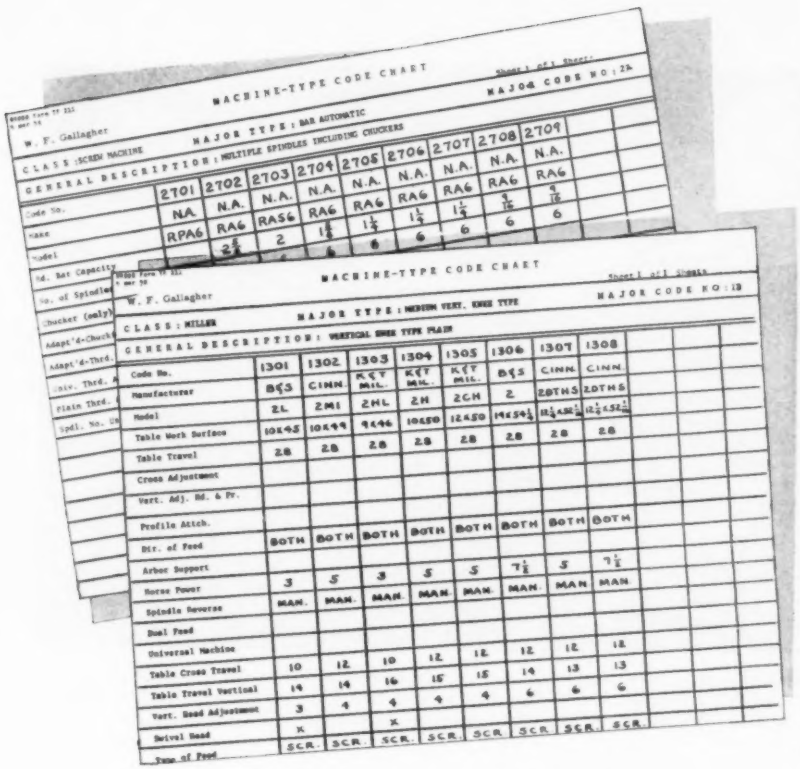
GM proposes revised JIC hydraulic standards

General Motors Corp has just released its proposal for revisions in Joint Industry Conference Hydraulic Standards for Industrial Equipment, for distribution to users and suppliers of machine tools and other metalworking equipment.

General Motors' revisions and additions are the result of consultation with the company's divisional master mechanics and plant engineers by GM's Plant Engineering Hydraulic and Pneumatic Equipment Committee. They will be submitted at the Joint Industry Conference for users and suppliers.

But before that time (probably next spring), the proposed GM changes are being circulated to interested firms to make sure that those firms are covered by the proposed standards.

Copies are available from Product Engineering Section, Process Development Staff, General Motors Corp, PO Box 128, Detroit 2, free of charge.



MACHINE-TYPE CODE CHART

W. F. Gallagher — MAJOR CODE NO: 24

CLASS: SCREW MACHINE — MAJOR TYPE: BAR AUTOMATIC

GENERAL DESCRIPTION: MULTIPLE SPINDLES INCLUDING CHUCKERS

	2701	2702	2703	2704	2705	2706	2707	2708	2709
Code No.	NA	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.
Make	RPA6	RA6	RAS6	RA6	RA6	RA6	RA6	RA6	RA6
Model			2	1⅝	1⅝	1⅝	1⅝	5/16	5/16
Std. Bar Capacity		2⅝		6	6	6	6	6	6
No. of Spindles									
Chucker (only)									
Adapt'd-Chuck									
Adapt'd-Thrd.									
Univ. Thrd.									
Plain Thrd.									
Spcl. No.									

MACHINE-TYPE CODE CHART

W. F. Gallagher — MAJOR CODE NO: 13

CLASS: MILLER — MAJOR TYPE: MEDIUM VERT. KNEE TYPE

GENERAL DESCRIPTION: VERTICAL KNEE TYPE PLAIN

	1301	1302	1303	1304	1305	1306	1307	1308
Code No.	B&S	CINN.	K&T MIL.	K&T MIL.	K&T MIL.	B&S	CINN.	CINN.
Manufacturer	ZL	ZMI	ZHL	ZH	ZCH	2	2DTHS	2DTHS
Model	10x43	10x49	9x46	10x50	12x50	14x54½	12½x52½	12½x52½
Table Work Surface	28	28	28	28	28	28	28	28
Table Travel								
Cross Adjustment								
Vert. Adj. Hd. & Pr.								
Profile Attch.	BOTH	BOTH	BOTH	BOTH	BOTH	BOTH	BOTH	BOTH
Dir. of Feed								
Arbor Support	3	5	3	5	5	7½	5	7½
Horse Power	MAN.	MAN.	MAN.	MAN.	MAN.	MAN.	MAN.	MAN.
Spindle Reverse								
Dual Feed								
Universal Machine	10	12	10	12	12	12	12	12
Table Cross Travel	14	14	16	15	15	14	13	13
Table Travel Vertical	3	4	4	4	4	6	6	6
Vert. Head Adjustment			X					
Swivel Head	SCR.	SCR.	SCR.	SCR.	SCR.	SCR.	SCR.	SCR.
Type of Feed								

Machine Coding System Streamlines Production Routing

Springfield Armory schedules job lots, checks machine loading, and puts the right job on the right machine because of a recently developed machine-type coding system. This classifies each machine tool and notes size and capacity, all with four-digit numbers. The system works like this:

By **William F Gallagher,** supervisory industrial engineer, Springfield Armory, Springfield, Mass

A machine-coding system can have far-reaching effects on production, costs, personnel, and efficiency. Springfield Armory's code system for basic machine tools has proved this. Some of the more important functions of the system are:

- Help pick the best machine with the right capacity for a job being routed
- Tie tooling to a specific machine, and identify all other machines on which the tooling can be installed
- Cross-check machine loading and indicate when a given machine type is under- or overloaded
- Help pick labor skills demanded by personnel

These improvements stem from a system developed after the Korean War, when Springfield went from a mass-production-line setup to a job-shop basis. The first results of the changeover were confusion, standards that could not be met, and an apparent lack of machine tools.

Reorganization

Armory engineers knew that sufficient machines were available for the job lots going through, and that the operators were skilled enough to meet any reasonable standards. The root of the trouble seemed to be production planning, which could route work through the proper general types of machines, but could not schedule work loads so each machine was fully utilized and none was idle.

The result was that tools were being installed on machines for which they were not designed, and the basic characteristics of each type of machine tool were not being properly considered.

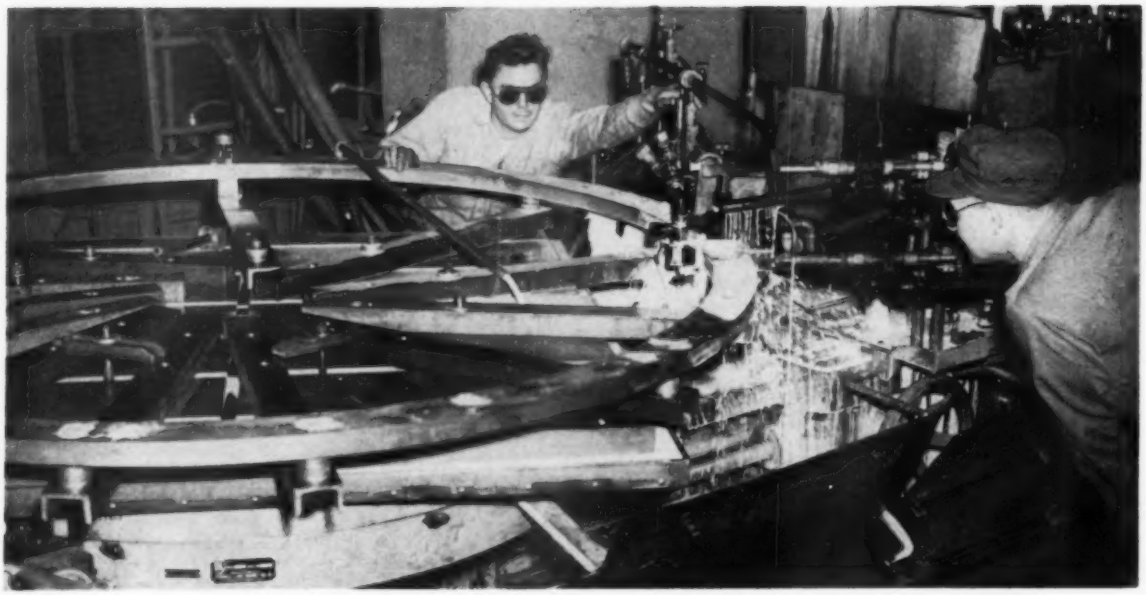
The code system combats this problem with a four-digit number that identifies the general type of machine with the first two digits, and the specific characteristics of the machine with the second two digits. These are called major and minor code numbers—major numbers being the general type, and minor numbers the specific combination of characteristics—such as power, table size, travel, and so on.

The Springfield code, for example, has 14 general types of milling machines, and from 1 to 22 minor code numbers for each major number. See accompanying sample charts. All machines are now tagged with their code numbers; and records, operation sheets, and process sheets are changed to indicate the proper code number when a machine operation is specified.

Because of the code system, the armory can now:

1. Specify the exact type of machine tool for a specific operation—presumably always the one best suited to the work.
2. Pick a specific machine for a specific tooling setup.
3. Classify and collect machine capacities for cost, volume, estimating, and planning purposes.
4. Plan work loads and routing schedules, knowing that the machines will be available when planned, or that one job must wait until another is finished.
5. Check machine utilization on any time basis, guided by code numbers indicated by setup men and operators on their job reports.
6. Group like machines together for convenience, and to allow quick visual inspection.
7. Specify grade of training and experience required to set up and operate each machine—which provides a better picture of labor requirements in the plant.
8. Determine the grades of labor required for a new job.
9. Identify machine-type shortages so new purchases will fill out capacity, not double up.
10. Develop lists of surplus machines.
11. Plan maintenance schedules.
12. Plan accessory and replacement-part purchases.

The coding system, developed by examining machine-tool catalogs and interviewing production engineers, provides a universal tool that helps solve difficult problems in machine loading, utilization, and purchase.



Rotary table moves CI ring past torches . . . on flame-hardening lathe. Ring sizes range from 50- to 120-in. OD. This 87-in. ring must be hardened on top face and also on ID and OD, so it is raised above support arms with stack of washers to provide better access to all 3 surfaces

Convert lathe to flame

Arc-shaped machine ways for the Variax profile miller are flame hardened as rings. Standard equipment was adapted for the job to provide uniform traverse speed for consistent case depth and hardness

By Hans F Krell, supervisor, Methods and Tool Design, G & L Hypro Div, Giddings & Lewis Machine Tool Co, Fond du Lac, Wis

Flame hardening a cast iron ring 10 ft in dia is no simple problem, but Giddings & Lewis has solved it with the combination of a rotary table and a specially equipped lathe.

We already had the lathe. For the past 10 years we have been using it for flame hardening the straight, flat CI ways for other G & L machines. Cylindrical shafts and large Davis boring bars are hardened in the same manner.

Specially converted for flame hardening operations, the lathe will handle round work up to 8 in. OD x 208 in. long and flat work up to 6 in. high x 16 in. wide x 170 in. long.

Pressure and flow gages and coolant and gas connections for flame hardening are mounted on a panel bolted to the lathe carriage. The panel is protected from the heat of the flame-hardening torches by a heat-resistant shield. The shield in turn is kept cool by coolant flowing down its face from the manifold nozzle held by clips across its top edge.

Hardening the rings

The specification for the CI rings call for a hardness of 50 to 55 R_c to a depth of approximately ⅛ in. Later they are cut into sections to make ways for the Variax three-dimensional profile miller. Both the column and the spindle head of this magnetic-tape controlled machine are guided through their paths by pairs of the arc-shaped ways.

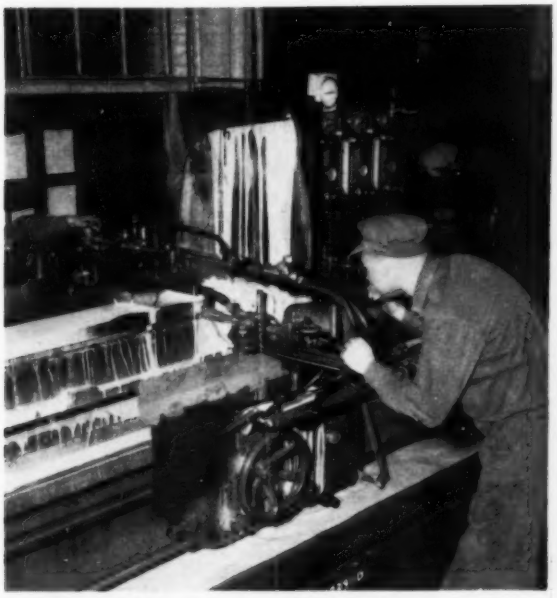
But, first, the ways have to be machined and hardened, operations that are performed more economically on a ring than on a segment. This procedure also keeps distortion to a minimum.

For the flame-hardening operation, we decided to adapt the lathe by mounting a rotary table across its ways. The table is a standard 60-in.-square G & L rotary table with a 180:1 reduction ratio.

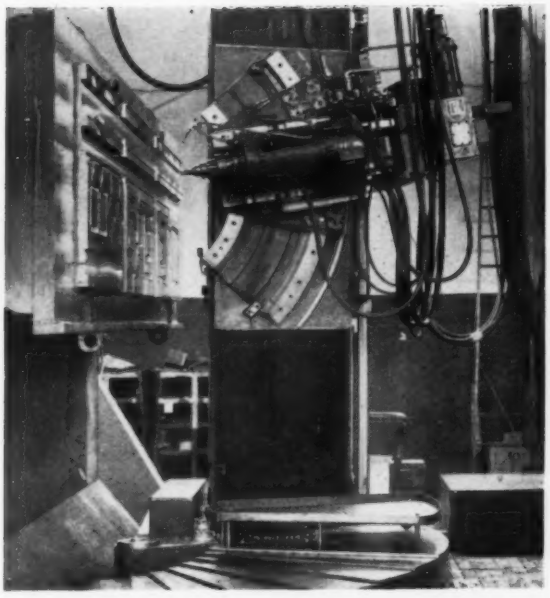
Then, because there are four sizes of cast rings ranging from 50- to 120-in. OD, adjustable support arms of structural steel channels were bolted radially to the table with sufficient overhang in each setup to hold the ring to be hardened. With this arrangement, it is an easy matter to mount the workpiece and then bring the heating torches and quenching nozzles on the lathe carriage into proper relation with the ring.

Up to the time the first Variax machine was built, we had flame hardened only straight CI ways. For these parts, experience had shown that a work speed of 4 to 4.6 ipm past the heating torches and quenching nozzles would achieve the desired ⅛-in. case depth and 50 to 55 R_c surface hardness. By testing some short, flat castings similar in cross section to rings, we found that about the same speed should be employed for the machined rings.

To provide a constant surface speed, a 1-hp DC electric motor direct connected to a 50:1 reduction gear box was mounted on a steel plate beside the lathe bed. The gear box was connected to the worm shaft of the rotary table with a 3:1 reduction chain-and-sprocket wheel drive. Total reduction was (50 x 3 x 180) 27,000:1 between the motor and the table. With a Thymotrol control



Straight machine ways are hardened . . .
on lathe specially equipped to carry flame-hardening torches and quenching nozzles at pre-established speed. Controls and gages are mounted behind water-cooled shield



Rings are made into machine ways . . .
after being cut into segments. Arc-shaped ways are used for both head and column of Variax profile miller

harden large rings

to adjust motor speed, this reduction ratio provided the desired traverse speed of approximately 4 ipm at the mean dia of the ring faces.

At first we had some misgivings about the possibility of warpage during flame hardening. However, production runs proved these fears to have been unfounded. In fact, we did not even have to clamp the rings to the supporting radial arms other than for alignment.

Before hardening, the rings are rough and finish turned and bored all over. Then the mounting-bolt holes are drilled and counterbored. These bolt holes are filled with plugs during the hardennig operation to prevent burning the edges.

After flame hardening, the rings are cut into four segments with a rubber-bonded abrasive cutoff wheel in a special setup on a planer. Additional holes are drilled and tapped, and the hardened side of each segment is ground to clean up in a large Mattison surface grinder. Then the segments are set up on their ground face on a planer, and the opposite face is machined parallel, leaving 0.015 to 0.020 in. of stock for finish grinding on both faces. Finally, the joint ends are ground to insure an oil-tight fit.

Flame Hardening Data for CI Way Rings

Operating Conditions	Ring Number 1	2	3	4
Size of Ring (inches):				
Outside Diameter	120	87	56	50
Inside Diameter	104	80	40	43
Mean Diameter	112	83½	48	46½
Face Width	8	3½	8	3½
Thickness of Ring	1½	1½	1½	1½
Table Drive Data:				
Total Reduction	27,000:1	27,000:1	27,000:1	27,000:1
Motor Speed (rpm)	275	400	650	650
Work Speed Under Flame (ipm)	3.6	3.9	3.6	3.5
Oxyacetylene Tip Sizes (length in inches):				
Main Tip (on top)	4	2½	4	3
Auxiliary Tip (on top)	3½	None	3½	None
Auxiliary Tips (on sides)	None	¾	None	None
Acetylene Pressure to Tips (psi):				
Main Tip (on top)	250	184	250	220
Auxiliary Tip (on top)	230	None	230	None
Auxiliary Tips (on sides)	None	11 & 13	None	None
Quench Pressure (psi):				
Main Nozzle (on top)	30	28	28	25
Front Nozzle (on OD)	21	17	20	5½
Back Nozzle (on ID)	21	7	19	7
Water Temperature (°F)	60	60	60	60
Hardness of Flame-Hardened Surface:				
Rockwell C	52-57	50-55	48-53	50-55
Scleroscope	75-80	75-80	75-80	75-80

Simpler method . . .
improves administration efficiency by making accounting faster and easier. Remington Rand SUIAP installation provides immediate access to the current state of any outstanding account

Simpler accounting eliminates bookkeeping lag

All billing information is in one place, no postings are necessary, and 10-12 days of lag in accounting have been eliminated by a simplified unit invoice accounting plan (SUIAP). It eliminates useless mathematics and shows up the important data: credit, billing, and payments

By Barton A Davis, asst treasurer, Hardinge Brothers, Inc, Elmira, N Y

Credit personnel can handle twice the volume of business as before, and can be trained for their work more quickly with a simplified accounting system installed at Hardinge Brothers to cover sales of lathes, milling machines, and accessories such as collets. The system keeps invoice files up to date, readily shows outstanding accounts, and allows much quicker crediting—all of which improve customer relations and reduce misunderstandings.

One of the advantages of the new system is that clerks can OK credit, except in special cases, because all outstanding bills are grouped by customer, with the oldest indicated by a signal. This alone has reduced a large amount of credit-department work.

No Postings

The system involves no posting because invoices are sorted directly into file pockets, by customer, each day. As they are filed, they are checked against a master tape provided by the billing department. Along with invoices, the file indicates how each customer usually pays, if he uses COD, and if his outstanding invoice total is higher than his credit rating.

Payment checks are mailed by customers directly to a bank, which supplies daily adding-machine tapes (and keeps photocopies of checks for six months). Invoices to match are pulled and totaled, and cash discounts are applied and totaled. Finally, these totals are checked against the bank statement, which leaves a relatively small area for error—and allows for much more rapid error searching.

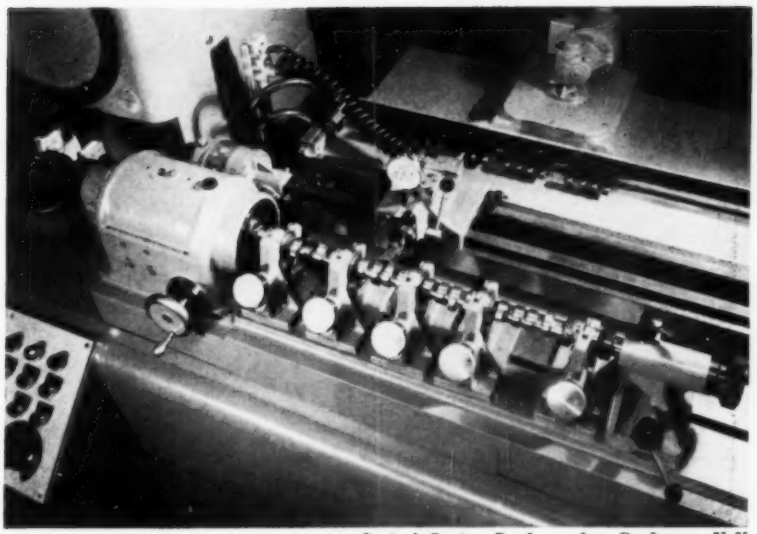
Greater Flexibility

Finally, paid invoices are filed by customer to establish a complete history—which also functions as a basis for sales analysis. Customer files also include copies of collection forms that indicate any differences in payment from the invoiced amount, which are thoroughly investigated before the customer is contacted.

Because the system is fast, control clerks can pinpoint delinquencies during the time from the 10th to the end of the month, rather than just once a month. This speeds collections and has improved customer relations, too. And the system allows monthly aged trial balances by charges, rather than by account balances, which improves follow-up and simplifies judging and adjusting credit policies.

The speeded-up accounts handling requires only three people, instead of six as before; and a 10-12 day processing lag has been eliminated. Furthermore, the new system can be taught in shorter time than the old, conventional ledger-card system that has been discarded.

The system removes the mechanics of arithmetic and is less monotonous than older accounting methods, and it gives personnel time to study the credit situation. SUIAP is expandable for the future; the two Safe-Desks, Safe-File, and two insulated tubs (all fireproof) can handle a 20% increase in the present total of about 10,000 accounts.



Optical Gaging Products, Inc, Rochester, N Y

Fig. 1—A camshaft checker . . .
utilizes the principle of a spring-loaded follower ball that traces the contour of the cam and an indicator ball will follow its position in relation to a master glass cam profile, both being projected on the screen. This method is fast and provides higher accuracy. The cam shaft checker rotates the shaft automatically to give the reading on the screen

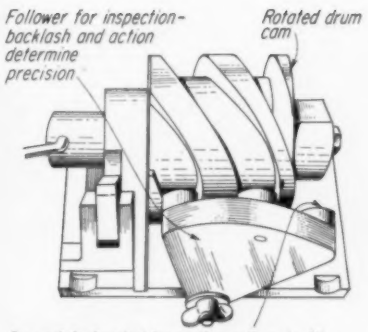

Follower for inspection-backlash and action determine precision
Rotated drum cam
Accurately located inspection rollers to fit in cam grooves

Fig. 2—A fixture . . .
used in checking a drum cam (having an oscillating follower) duplicates working conditions. In this application the roller size suited the track width for intermediate cutting prior to the finish grinding

Here's Your Guide to

Cam-inspection equipment

Cams are becoming more important—especially precision-type, radial, cylindrical and 3-dimensional cams. You will find that it's no cinch to inspect these cams for high-speed machinery and missile work. Here is the first analysis of the kinds of cam-inspection devices made in this country or imported

By Harold A Rothbart, associate professor
of mechanical engineering, The City College of New York

Rarely does an actual cam agree with the theoretical mathematical profile. When the differences exceed a reasonable minimum value, as determined by the cam function and application, we speak of them as errors. These errors require that highly accurate inspection equipment be employed to check the profile. Cam contour inspection methods may be divided into three types:

Templet method—an accurate templet is compared with the actual cam. The over-all accuracy and speed of measurement depend on the equipment employed, such as the optical comparator, air gage, or "Probograph."

Micrometer method—a suitable fixture indicates the cam contour dimensions on a dial indicator. These measurements are either in rectangular coordinates or polar coordinates. The latter is less sensitive. This approach of measuring a cam contour against a master cam or tabulated data is time consuming.

Electronic methods—one of these methods uses an electrical circuit with an oscillograph to record the acceleration curves of a cam. This equipment is rapid, accurate and more reliable than the others and is especially valuable for investigating high-speed machinery cams. Appraisal of the acceleration curve will indicate the dynamic follower performance in contact with the actual cam. In this way, excellent results are obtained because the true dynamics of the cam profile are indicated.

The other electronic methods employ automatic digital gaging, and fringe-count methods of monochromatic light waves.

More detailed discussion follows on various cam-inspection devices.

Optical Comparators

The fundamental principle of this comparator, or contour projector, is the projection and magnification of an image of the object on the glass screen. Sometimes a previously made templet, which shows the magnified basic dimensions or the ideal contour and tolerance zones, is attached to the screen. Micrometer cross-slides and rotary stages (simple or optical) are available for more exacting measurements. The accuracy is limited by the sharpness of the image and the degree of enlargement of the original cam size.

Another type of optical comparator

Cam-inspection equipment . . .

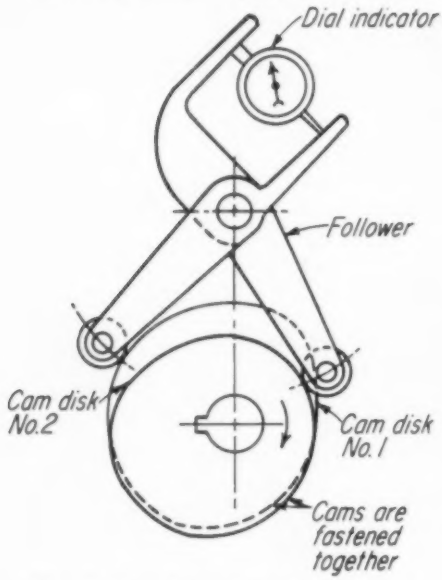


Fig. 3—Complementary device . . . used in cam inspection determines the accuracy of cams in relation to each other. The arms and roller sizes are made the same proportions as the follower mechanism. A dial indicator determines the deviation

is shown in Fig. 1 for checking camshafts.

Still another type of optical comparator is the so-called toolmakers' microscope, in which the magnified image of the work is observed through an ocular and compared with a clear glass graticule. Furthermore, a tracer attachment can be adapted with this instrument. The tracer is brought in contact with the work to be measured by means of the two-direction micrometer screws. This latter method is slow and not often utilized.

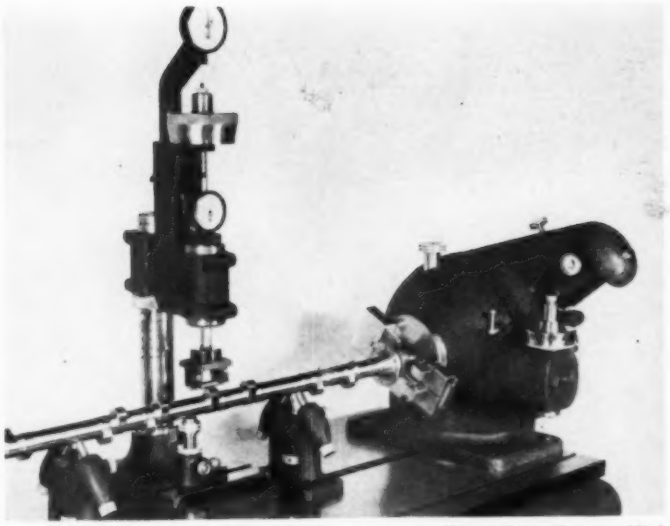
Special fixtures are shown in Figs. 2 and 3.

Universal Measuring Machine

Universal measuring machines are available for cam inspection designed in the same general character and incorporating the basic principles of the jig borer, ie, rectangular coordinates.

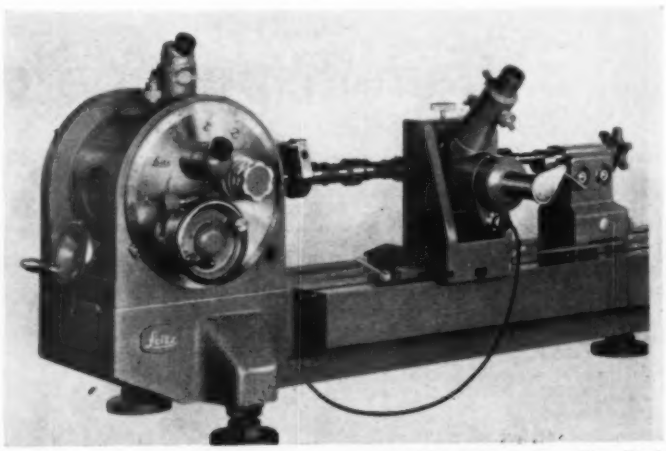
Indicator and Dividing Head

This method of accurately checking cams is suggested by the cam-follower arrangement itself. A fixture is devised to determine (for an accurately determined angular position) the lift produced by a cam contour to be precisely indicated. The devices shown in Fig. 4, 5, and 7 are used in a number of leading shops in the United States.



Vinco Corp, Detroit, Mich

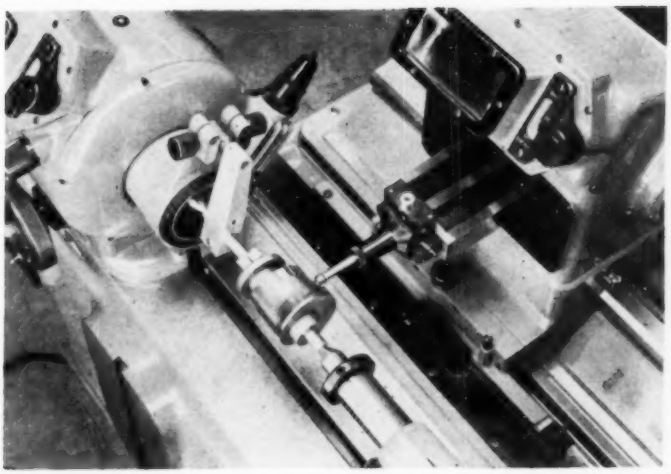
Fig. 4—This instrument utilizes optical rotary head . . . and two dial indicators for inspecting cams. One indicator shows the rise and fall at each increment station while the other records the accumulated rise or fall over the total intervals. The dial indicators in general must be capable of reading to ±0.0001, some to ±0.00005 in., with the dividing head able to read in minutes. A flat-faced follower is often suggested for its greater accuracy and longer wear life than the point or roller follower



Opto-Metric Tools, Inc, New York

Fig. 5—Leitz cam tester employs a horizontal plunger . . . for measuring. It is guided in a long bearing and contacts the cam contour under constant pressure. It employs an optical master dividing head for accurate setting of angles and an optical measuring head for reading amount of lift. The accuracy in cam checking does not only depend on the measurement of the rise and fall, but also on the exact angular position of the cam by reference to the blueprint. Today there are precision cams in use that are checked over their contour in a hundred or several hundred positions, some of which are specified in seconds of arc. Accordingly the dividing head used for the angular spacing is also required to have an extreme indexing accuracy. In the Leitz optical master dividing head the reading is directly in 2 sec, with a possibility of estimating 1 sec. Because the greatest single source of errors is possible run-out, the Leitz optical dividing head incorporates two features; namely, a special spindle construction and a double microscopic pick-up.

The Leitz cam tester uses a 4-in. master glass scale, which is divided in 0.050 in. Each interval is subdivided in a purely optical measuring ocular directly in 0.000050 in. Each interval of 0.000050 in. appears as large as 1/16 in.



Precision Grinding Co, Ltd, England

Fig. 6—Universal optical measuring machine . . . may be applied in the shop for checking and inspecting a three-dimensional cam master. This instrument employs an optical dividing head for rotation and two optical slides, one of which allows us to read the axial position of the follower with respect to the contour while the other reads the position of the center of a ball probe with respect to the center of the cam. Linear motions can read to about ±0.00005 in.

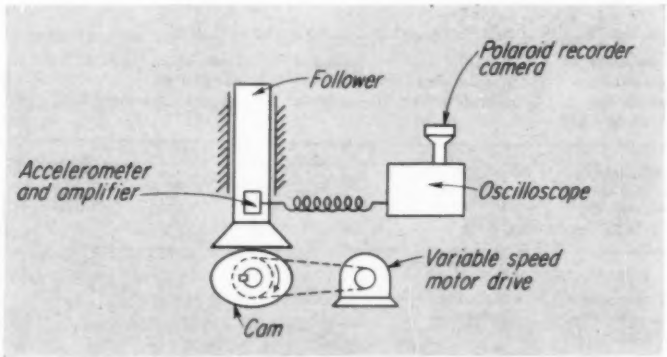
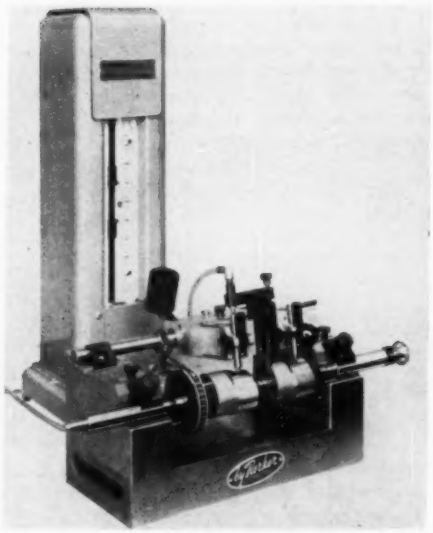


Fig. 8—Electronic cam tester . . . with accelerometer gives the acceleration curve directly



Parker-Hartford Corp, Hartford, Conn

Fig. 7—Air-gage comparator . . . compares a mass-produced, three-dimensional cam with the master cam mounted on a common arbor. By rotating the checking arbor and moving the hinge axially, the entire surface of the production cam can be explored while the air column indicates the deviation between it and the master. With the fixtures shown, cams up to 2¾ in. dia and 2¾ in. long can be measured in as little as 5 min. to a comparison accuracy of about ±0.0002 in.

Electronic Inspection

The application of electronics may be employed in many ways to inspect the contour of a cam. One procedure permits studying the displacement velocity and acceleration curves by only the turn of a selector switch. It is excellent for studying the cam when curve plotting of the cam profile is not necessary.

In actual inspection work the lift curve is not of much value because small errors are not apparent. The velocity curve reveals the errors more readily whereas the acceleration curve reveals the local irregularities even more readily, more accurately than obtainable by calculation from lift figures measured to ±0.00005 in.

The equipment is constructed of a follower, flat or roller, held against the cam lobe by means of a light spring, and rotating between 200 and 400 rpm. A velocity pickup is mounted as a follower to sense the rise and fall of the cam as it rotates at a constant speed. Electric impulses from the velocity pickup are transmitted to an oscilloscope which transmits the impulse to the velocity diagram. With integrating and differentiating circuits it is possible to convert the velocity traces into lift and acceleration curves.

As an alternate (Fig. 8) the writer finds a much simpler arrangement is by utilizing an accelerometer to yield the acceleration curve directly, the only one usually needed.

Automatic digital gaging has been developed by International Business Machines Corp, using the same equipment as employed with the numerical-controlled cam milling machine but having in addition a stylus with its associated electronic amplifier and an electromagnetic typewriter. A typed record of the cam profile is yielded.

The University of Chicago developed an ultra-precise rapid method of angular measurement based on an adaptation of the Michelson interferometer. This instrument is extremely flexible in application and is capable of dividing the circle into small divisions, yet it has the additional advantages of requiring no master and of checking itself. Used by counting circular fringes, which are established in seconds, the device is applied industrially to measure the accuracy of rotary tables. In this application the interferometer utilizes as a standard of comparison the fixed value of monochromatic light waves, self checked by the final closing of the circle.

Link Aviation Inc, Binghamton,

Cam-inspection equipment . . .

N Y, has developed a similar instrument, the "Fringe-Count Micrometer," which may be employed for automatic cam inspection to the highest accuracy. The automatic inspection device yields a printed readout of lift *vs* cam rotation.

The Control Instrument Div, Warner & Swasey Co, New York, N Y, has a commercially available universal "Probograph" which works by means of an electric pressureless probe with instantaneous recording. It may be employed with any shape or type of cam, including radial, cylindrical, and three dimensional. The most conventional way to check a cam, particularly for production purposes, is by measuring deviation from nominal dimensions (inexpensive master drum). The master dimensions are represented by small black dots in a straight line (one dot per measurement) while the deviations are represented by small black dots (stylus) deviating from the straight line of the master dimension in proportion to the profile error. The master drum has recorded in the form of small holes the nominal measurements of the cam at a given station. By means of a photo-electric scanning system these marks are picked up by the machine and compared to the actual measurement.

Applications of Cam-Inspection Equipment

	Machine	Fig. No.	Cam Types	Use of Machine	Comments	Accuracy*
	Standard optical comparator		Radial cam - surface	Casts a magnified shadow of cam on screen		±0.005 in. to ±0.020 in.
	Optical comparator. Optical Gaging Products, Inc.	1	Radial and cylindrical cams-surface	Spring-loaded follower ball		±0.001 in. to ±0.002 in.
	Toolmaker's microscope		Radial cams - surface		Slow, tedious. In general not suggested	±0.001 in. to ±0.005 in.
Special Fixtures	No. 1	2	Cylindrical cam - groove	Templet comparison	Rollers fit in groove	±0.0001 in. to ±0.0003 in.
Special Fixtures	No. 2	3	Complementary cam	Uses a dial indicator to give errors		ditto
	Universal measuring machine		Radial cams - surface or groove	Rectangular co-ordinates	Similar to a jig borer	ditto
Indicator & Dividing Head	Dial indicator and standard optical dividing head. Vinco Corp.	4	Radial or cylindrical cams-surface or groove	Incremental polar co-ordinates	Slow, which is essential to extreme precision	±0.00005 in. to ±0.0002 in.
Indicator & Dividing Head	Optical dividing head and optical micrometer. Opto-Metric Tools, Inc.	5	ditto	ditto	ditto	±0.00005 in. to ±0.0001 in.
Indicator & Dividing Head	Optical dividing head and optical slides. Precision Grinding Co., Ltd.	6	Three-dimensional cams	ditto		ditto
Indicator & Dividing Head	Air gage comparator. Parker-Hartford Corp.	7	Three-dimensional cams	Compares to master cam	Fast and provides high accuracy	±0.0001 in. to ±0.0005 in
Electronic	Velocity pickup and oscilloscope		Any shape of cam	Determines acceleration curve of cam	Provides true picture of dynamic forces	±0.00005 in.
Electronic	Accelerometer and oscilloscope	8	ditto	ditto	ditto	ditto
Electronic	Digital gaging system. International Business Mach. Corp.		ditto			±0.0005 in. to ±0.001 in.
Electronic	Fringe count micrometer. Link Aviation, Inc.		Radial cam	Utilizes monochromatic light waves	Highest accuracy	±0.000005 in. to ±0.00001 in.
Electronic	Probograph, Warner & Swasey Co.		Any cam	Compares probe dimensions to a master	Fast, accurate method	±0.00003 to ±0.0006 in.

*With care and experience the closer tolerance can be achieved.

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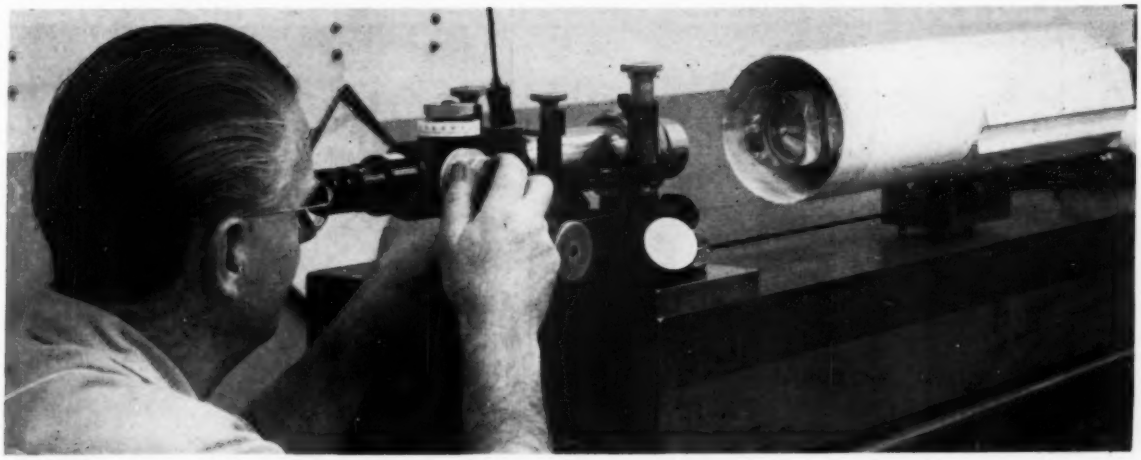


Inspecting the inside of long tubes . . . is simplified by special tools developed for checking the inner surface of jet tanker-transport refueling booms. Observer gets a 360° panoramic view of surface as tool is moved through the boom

Seeing-eye tool inspects long bores

How do you check every square inch of the inside of a tube that is 25 ft. long and only 5½ in. in diameter? It's no problem at all with this specially designed optical tool

By Robert Weglin and Fred R Miller
manufacturing research, Boeing Airplane Co, Seattle, Wash

A "seeing-eye" tool has been developed by the Boeing Airplane Co for checking the entire inner surface of jet tanker-transport refueling booms prior to machining. The boom tube carried by each KC-135 jet is 25 ft long and only a bit over 5½ in. OD. Design engineers were specific about the absence of internal cracks and defects—leaving inspection people in a quandary. They had no instrument for such a critical examination.

The tubes are received as rough extrusions. If they are accepted and internal defects show up during machining, money is lost in useless manufacturing. If the defects are not caught, a boom might fail in use.

Manufacturing research engineers came up with the answer to this problem—a "panoramic optical system." While it might be described as a borescope, this tool is a far more advanced instrument. The borescope amounts to little more than a mirror placed inside a tube to enable the viewer to scan just one point of the bore at a time. This tool gives him a 360° sweep.

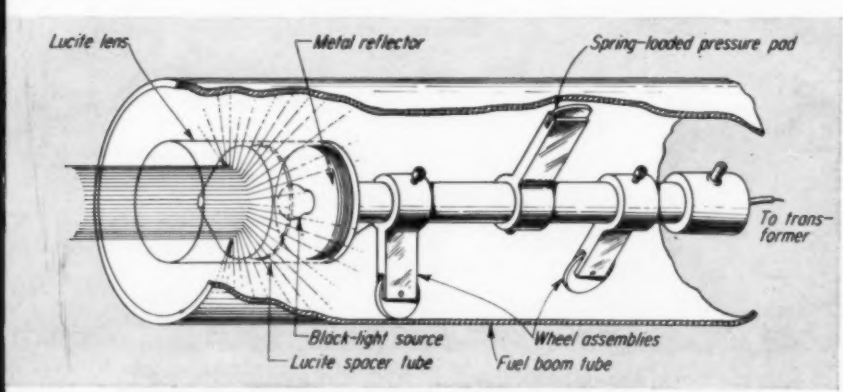
Operation is simple. First, the inside wall of the tube is flooded with Zyglo, a penetrating oil containing fluorescent particles. The surface is then washed with an emulsifier. The cracks and pits retain the fluorescent particles, and under black light they glow brightly.

Then the optical tool is placed in the boom. Its circular field of vision fans out from the line of sight, in this case the center of the tube; and as the tool is inched slowly through the tube, the observer sees the entire inner surface.

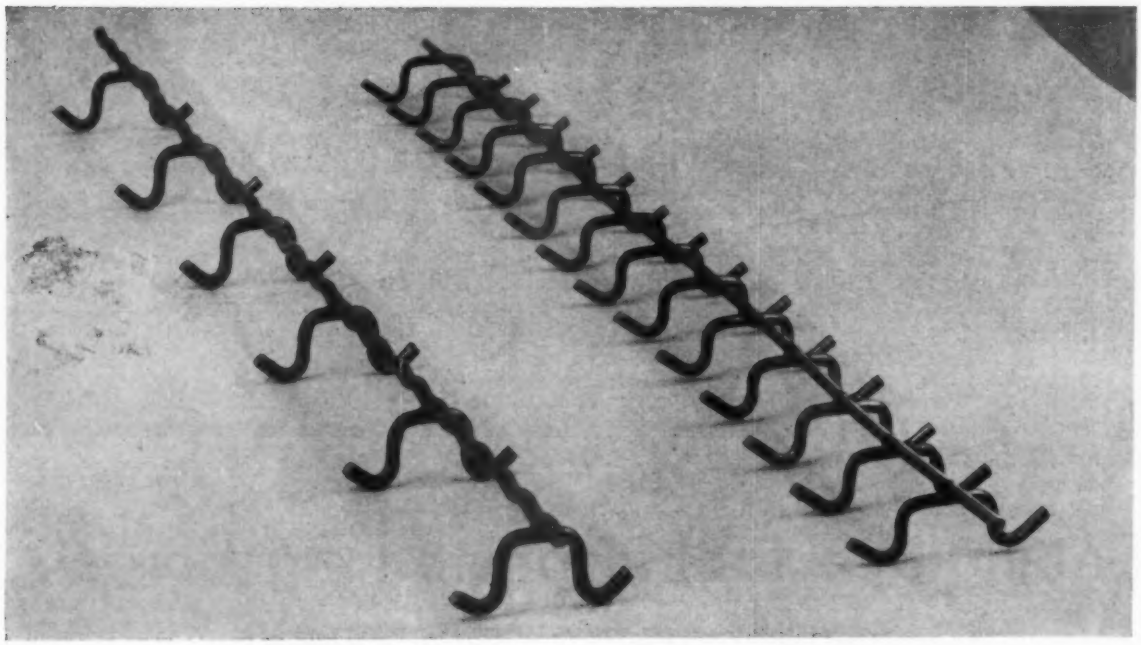
The lens, the critical part of the tool, is 3 in. in diameter, about 2½ in. long and is made of Lucite—an ideal material for transmitting the shorter wavelengths of light. One end of the lens is ground flat; the other is ground with a 70° conical cavity. A Lucite spacer tube joins the lens to a metal reflector which holds a black-light source.

Because this lens provides no magnification, an infinite-focus, 30-power, micro-alignment telescope is set up near the far end of the boom. Light rays hit the conical end of the lens and are bent parallel to the line of sight, giving the inspector a view of the entire illuminated area.

Boeing research engineers report that this instrument is adaptable to close inspection of all internal diameters, from a half-inch up.



Heart of the tool . . . is the Lucite lens which transmits the image of the inner surface to the viewing telescope. The black-light source illuminates an area about 2 in. long as the tool is moved through the tube. Wheels and pressure pad serve as guides



Wire bolsters support reinforcing rod in concrete construction

Welding and forming combined

Combining operations is one of the classic techniques for increasing both output and efficiency. Here it is put to good advantage in an automatic machine that triples the output of wire bolsters

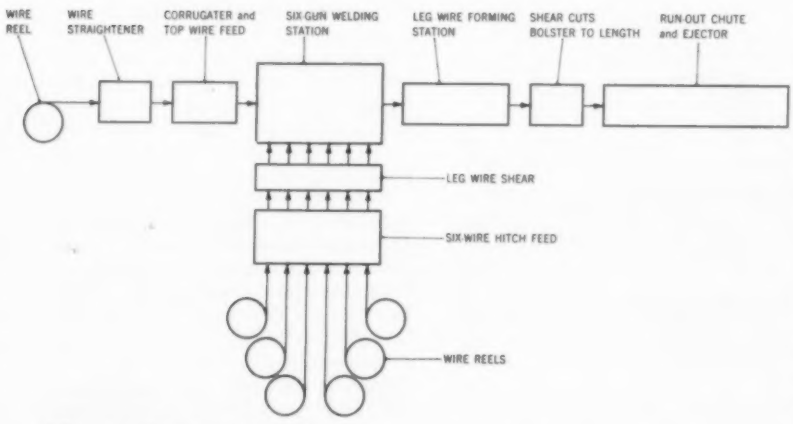
An integrated machine performs a complete manufacturing lineup to produce these wire bolsters at the rate of 5000 ft per hr. Feeding, forming, welding, and cutting-off are all combined in the one machine, a product of Precision Welder and Flexopress Corp of Cincinnati.

The bolsters, made of No. 4, 5, and 7 wire, are used to support reinforcing rods in concrete construction of walls, floors, and overheads. They are of two basic types: slab bolsters whose top strand of wire is corrugated on 1-in. pitch centers, and beam bolsters whose top strand is straight. Both types call for formed wire legs to be welded to the top strand on various spacings from 2 to 5 in. Leg heights vary from ¾ to 3 in.

Both bolster types are produced on this one machine. In addition, the machine is capable of producing several sizes of "high chairs"—similar to bolsters but with longer legs.

The new slab-bolster production rate of 5000 ft per hr is more than 3 times as great as previous rates, which averaged about 1550 ft per hr. At the same time, welding strength and consistency has been improved considerably.

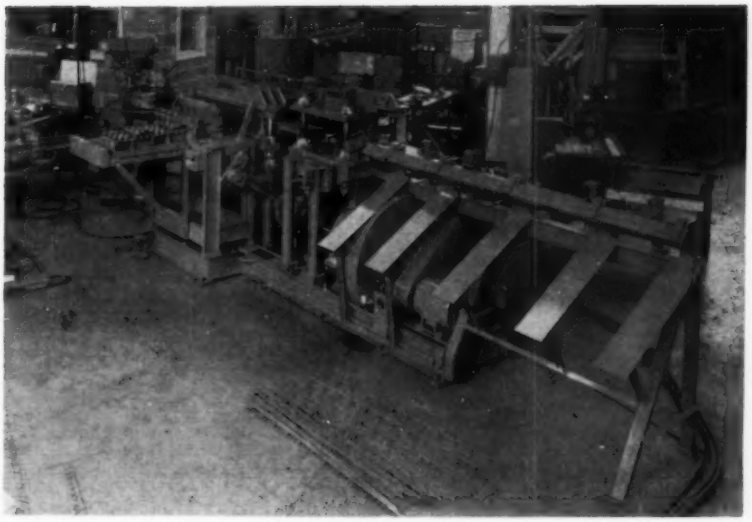
Schematic Diagram of
PRECISION Automatic Bolster Welding and Forming Machine



All operations are combined . . .
in one machine that turns out wire parts three times as fast as former method

Operation sequence

Adjustable-feed corrugator wheels pull the top strand wire from its coil through a straightener and feed the corrugated wire lengthwise into the welding station. The corrugator wheels are extra wide and can be shifted to provide even wearing. They can be replaced with smooth wheels to feed straight wire.



One 5-hp motor does all the work . . .
on this machine that automatically turns reels of wire into finished products

Working from the side, a hitch-type feed pulls as many as six wires through their own straighteners and feeds them into the welding station at right angles to the top strand wire. The hitch feed is fully adjustable for both length of feed and spacing between wires.

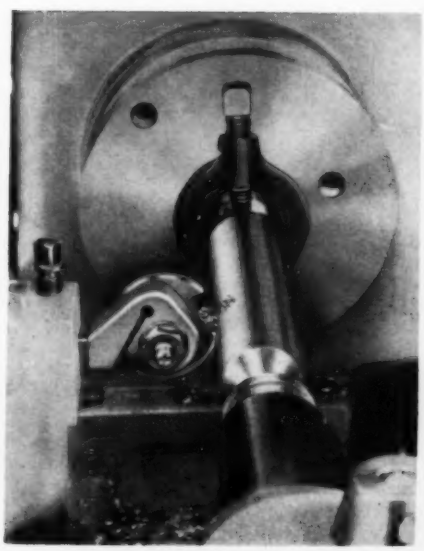
The welding station is composed of six special Precision pincher-type guns, which are readily adjustable for various leg spacings and are fired from three 50-kva dual-secondary package-type transformers. A shear between the hitch feed and the welding guns is timed to shear the legs to length—after the guns exert clamping pressure but prior to weld-current flow (to prevent shorting). On a typical run during try-out tests, the welding time was set at 10 cycles with 6.3 volts and 18,000 amps.

After welding, the part is transferred to the leg-forming station, consisting of a four-post double-crank press with appropriate dies to form leg wires. An extension of the upper platen carries an alligator-type shear which cuts completed bolsters to any desired length. An air-operated run-out chute ejects them onto a bundling table.

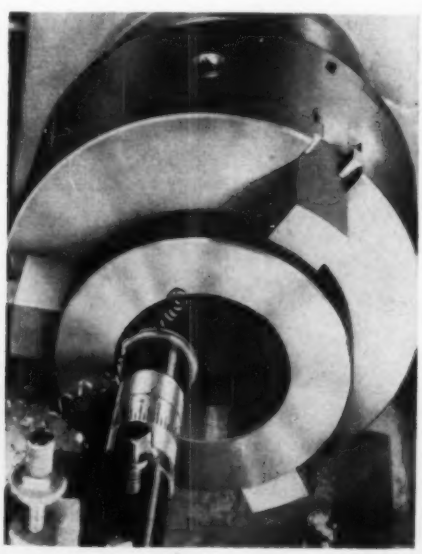
All elements of the machine are driven and timed from a main crankshaft which is coupled to a 5-hp motor and flywheel by a heavy-duty air clutch and brake.

Double-Point Threading Tools . . .

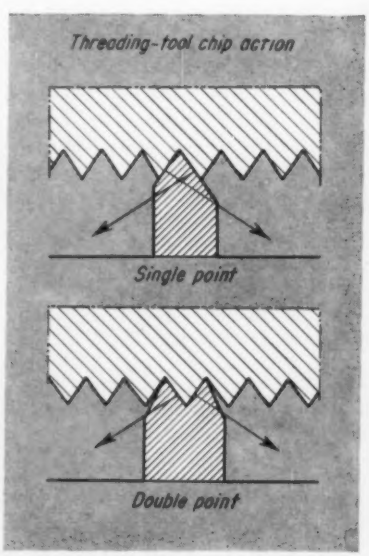
. . . They separate chips, minimize tearing, and reduce burrs



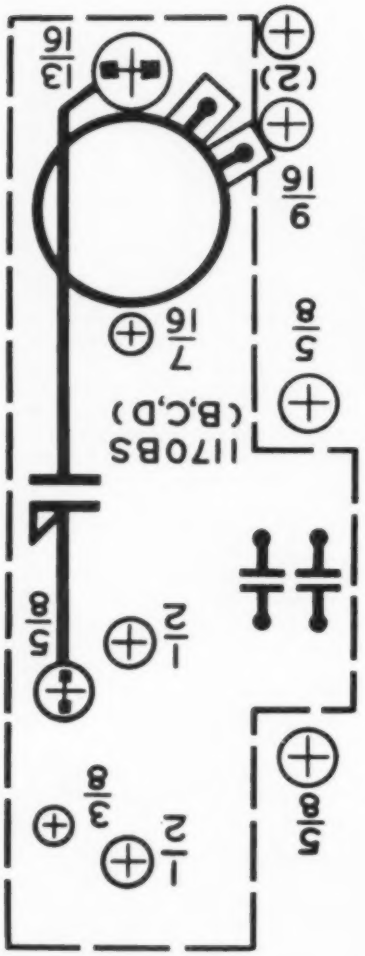
External threading tool . . .
is produced by Mécanique et Plastique, Geneva, Switzerland, to cut single threads with double edges. Circular tool permits repeated regrinds; knee-action holder absorbs vibration

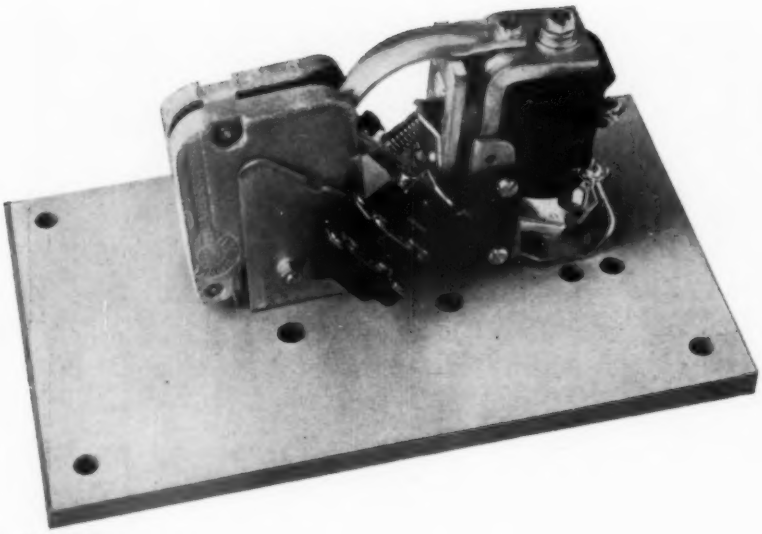


Internal threading tool . . .
has similar construction, plus barrel scale for adjusting cutter depth without resorting to carriage turret. V or Acme cutters are produced



Double tool cuts . . .
only at inside edges; outside edges clear the work on final pass. Chips spread away from each other to prevent interference, rubbing, and galling. Faster cutting, less tearing, and lower skill level are claimed

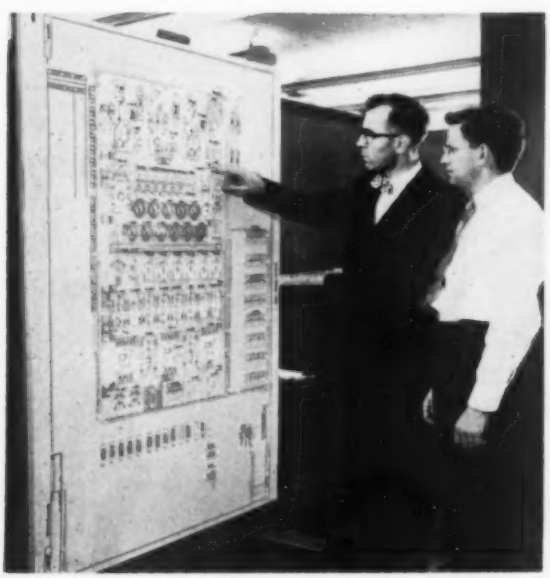




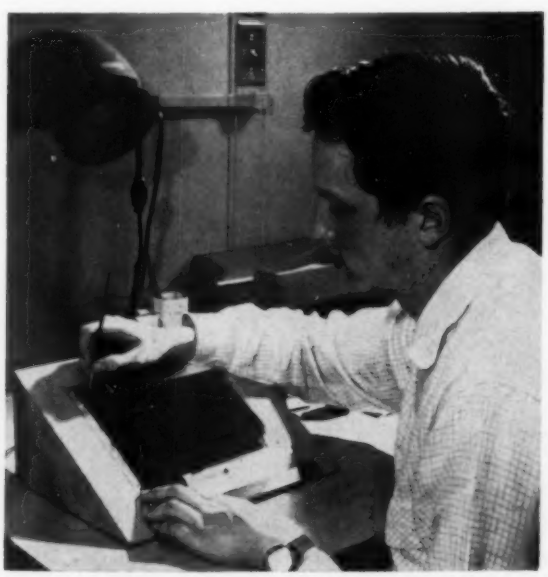
Symbolette . . .
is part schematic, part templet. Outlines and holes are to scale, and element symbols are located to show clearances. Mounting boards can be drilled accurately by scaling and reading notations. Symbolette (left) is for part above

Symbolettes simplify

GE makes scale drawings of electrical elements like switches, relays, and terminal boards, then photographs them for rapid reproduction. Elements are combined to build panel-board layouts, and the layouts are photographed. Result is quick, standard drawings that replace schematics but are much easier to read and interpret on the production floor



Magnet board . . .
holds completed layout for final check and photographing. Different dye colors on symbolettes and background can be filtered to make a complete assembly drawing or only show material for drilling templet



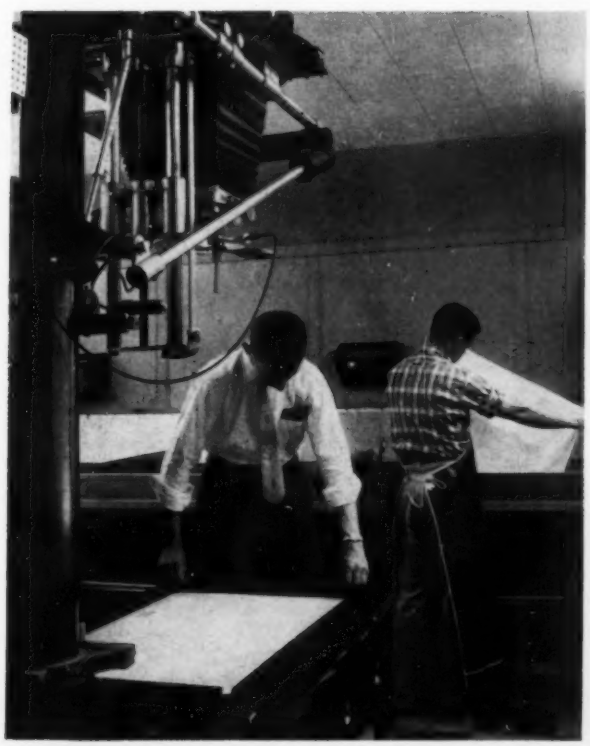
Connecting lines . . .
are added and adjustments are made on photo negative. If a component must be changed, layout can be reassembled with one or two new symbolettes and quickly shot over again

Original drawing . . .
is made of component on opaque, stable paper, then photographed to standard scale reduction. Prints are then enlarged to full size to make symbolettes

Equipment layout . . .
is made to locate panel holes or to act as model for assembly drawing. Spacings, wire routings, interferences, and convenience can all be checked at this point. Buildup takes only minutes

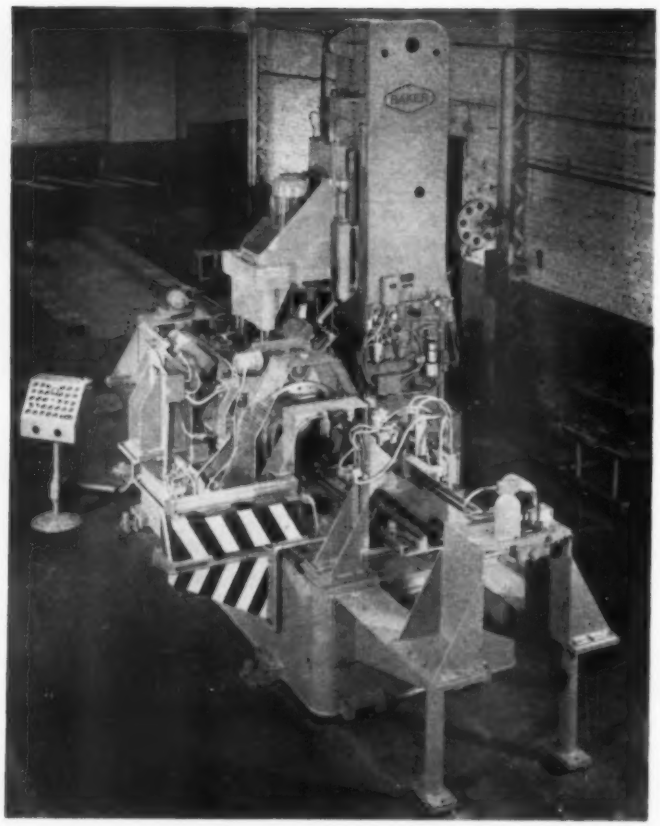
electrical drafting

By D F Thompson, industry control dept, General Electric Co, Roanoke, Va



Copies are shot . . .
photographically to any scale required, though drill-templet copies are usually blown up to full scale

Templet copy . . .
is sent to shop where panel base will be cut and drilled to exact size required. Hole locations are close enough to be scaled



Logic controller . . .
on this special Baker Brothers machine performs pre-process inspection. At the beginning of the engine-block line, it measures the wall thickness of the V8 blocks and automatically controls positioning and cutter movement to provide the desired thickness in subsequent operations

How to understand automatic control

PART II —*From signals to servos to systems*

By George H Amber and Paul S Amber

Amber and Amber, consulting engineers, Detroit

What mental processes must a control system duplicate before it can replace a human operator; what is the job to be done and what are the skills of the operator? Is decision or compensation or *premonition* necessary? From a simple pushbutton to a giant general-purpose computer, a wide choice of control techniques is available—and there is a best way to do each job. Following the basic data in Part I (*AM*—Sept 22 '58, p110) this article describes system characteristics

Some years ago the builder of a large line of widely used machine tools developed an automatic control for these machines. When asked recently why the automatically controlled machines were never marketed, the builder replied, "Bugs." He went on to say that the company had built and operated these machines for years and thought it knew all about them, until automatic control was added. It was surprising how many functions were performed by the operator that went unrecognized until he was taken off the machine!

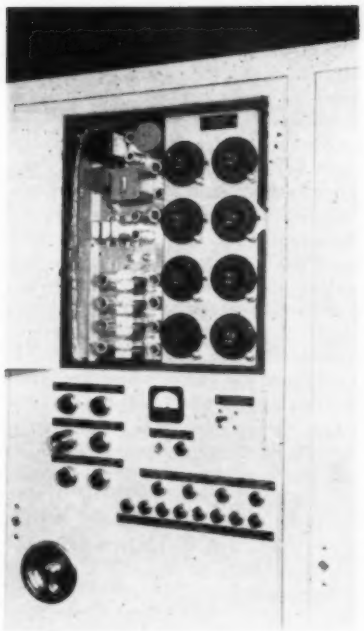
This remark is the key to successful selection, or design, of automated equipment: Do a detailed methods analysis of the job to be done automatically; then carefully study every element of material, mechanical equipment, and control—and recognize the operator's contribution to the control function to the smallest detail.

Modernization, today, takes on important new connotations when it is considered as improvement in fundamental technology and not as just installing a better piece of equipment. Information-handling devices, especially the automatic units, represent, to some people, as important a change in manufacturing productivity as the shift from waterwheels to electric motors or, at least, from lineshafts to individual power units.

Some time ago it was recognized, with a fair degree of validity, that not much could be done to improve the actual cutting time of present-day equipment. However, the real time loss was in non-cutting time, in loading and unloading work, in changing tools, in setting up the job, etc. Concentration on this area of saving has resulted in sizable improvement. But automatic control offers another major cost improvement—still largely untapped.

Mechanization of information handling does more than just cut manufacturing costs. It affects entire processes. It changes the skill requirements of employees, hence the labor demand. Automatic control increases the continuity of production so that while parts may not be machined faster, more machining can be done in an eight-hour shift. In some instances, cutting time is shortened because optimum conditions—feeds, speeds, positioning—can be utilized. And better control reduces errors, simplifies follow-up or assembly operations, minimizes inventories, in short provides a variety of valuable fringe benefits.

Simple signals, such as result from machine On-Off switches, are a form of control, but not of *automatic* control. Automaticity starts where the control can make decisions—even the simplest decisions such as the On switch kicking out if the circuit is overloaded, a circuit breaker. The "jog" switch on a machine tool provides elementary automaticity because a single touch of the button



Computer control . . .
for contour milling, called the Computrol, keeps the feed rate constant by varying the angular velocity of the work spindle in accordance with a continuous solution of the contouring process equation. Practically impossible for a human operator to resolve, the equation involves: work-spindle velocity, slope of work surface at cutter contact point, rate of change of slope, radius of cutter, instantaneous distance between cutter center and center of rotation of work, radius of base circle on which cam or master part was constructed, radial displacement of secondary cam follower, and lateral displacement of the latter

causes a Start, a short increment of motion, and a Stop.

From this point, automatic control develops rapidly. When signal units are assembled to complete a cycle of operations automatically, the control combination is called a *system*. If this control system is monitored by feedback devices it is said to be a *closed loop*. Without feedback, the control can be automatic but it is called an *open-loop* system—not self-correcting.

Each command given a machine by its operator is in signal form—either digital (pushing a button) or analog (turning a handwheel). Automaticity results when the signals, or commands, are provided by the control system.

Digital-analog control

Some analog machine controls, such as leadscrews and gearing, respond to digital-impulse signals. "Numerical Control" machines are an example, whereby the continuous control of tool and work position responds to pulse counts and stepping-switch position. Logical-mathematical controls (to be covered later) are usually digital methods superimposed on an analog mentor.

"Operational-digital" techniques combine the advantages of the two conventional methods, operational analog and programmed digital. Over simplified, they offer the accuracy of digital with the simplicity of analog.

Ordinarily, digital systems must be programmed, and this requires complex circuitry. Analog systems usually operate continuously and concurrently, not sequentially, hence simple programming suffices. In "operational-digital," the functional elements are digital; that is, they handle counts and not levels. Functional elements are arranged as in an operational system whereby all units work concurrently, not sequentially, as in conventional digital systems. For example, an analog discriminator compares voltage levels. Operational-digital discrimination is performed by adding and subtracting a series of pulse counts.

Operational-digital summation of pulse counts replaces analog *time* integration, such as that done by the common kilowatt-hr meter. The analog method of representing a velocity is by a voltage lead from a tachometer generator; the operational-digital method measures it by counting pulses during the elapsed time of the action. Once the time has elapsed, the value of the velocity is fixed and can be handled just as an analog signal.

Analog-to-digital conversion

Process variables are commonly of a continuous nature and it is easier to sense them by continuous analog rather than by digital impulse. Control systems are basically digital. It is common practice to perform automatic analog measurement and sensing, such as of temperature, pressure, size, force, rpm, etc, then make the analog signals available to the relays, static elements, and numerical control digital systems via an *analog-to-digital converter*.

Typical transducers that can be used to change physical properties to analog signals are thermocouples, strain gages, differential transformers, carbon-pile blocks, and the tachometer generator. In that order, these analog transducers are suitable for instrumenting the five variables mentioned above.

Because human operators can read a series of digits more rapidly, and with less danger of error, than they can interpret dial-pointer positions, instruments now available give a visible digital readout from analog-input data.

Among the many techniques for performing analog-to-digital transformation is the one using a direct count of signal pulses, the frequency of which is proportional to the level of the analog signal. Also, by increasing the signal in incremental steps, each step corresponds to a digital value.

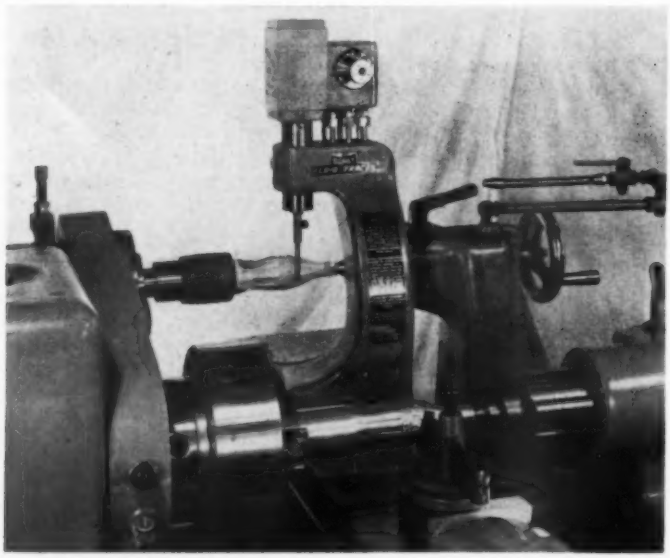
Continuous vs discontinuous process . . . the difference between a continuous and a discontinuous process is the difference between a *continuous* part, or a *continual* stream of parts, and a periodic *batch* of parts. Continuous processes are those that are more or less continuous in time, with no breaks for an appreciable period. Examples are heat treating and brazing in a pass-through oven.

Many automatic processes, such as automation, are continuous because discontinuous operation usually means unproductive waiting time between operations.

Examples of discontinuous processes are the job-shop techniques used to make parts in batches. Specific job-shop operations, such as turning, milling, or welding, may be continuous in nature, however.

It is easier to control continuous operations than discontinuous operations, mainly because control of intermittent or discontinuous operations requires extra equipment. There must be some means for controlling the transducer sensor signals to properly select the dimensions being instrumented. Also, part of the discontinuous data must be placed in some form of memory storage, so that it can be used for determination of average performance, and level of dispersion of performance.

Continuous and discontinuous products . . . Continuous products, such as strip, wire, roll-formed sections, pipe, gasoline, and cereals are always produced by continuous processes. *Continuous*, modifying *product*, refers to surface measurements; *continuous*, modifying *process*, refers to time. As usually interpreted, automation is a continuous process. But most automated individual machines produce discontinuous piece-parts. The automation process is continuous in time but the pieces are discontinuous in space. Automatic instrumentation of individual piece



Open-loop automatic control . . .
is typified by contour tracing equipment. Cutting tool is automatically manipulated by the system as the stylus follows the master. However, there is no feedback. Corrections for tool wear, etc, must be made by the operator

dimensions is less readily accomplished than it is for a continuous variable, like a strip mill. One reason is that a continuous variable (a dimension, for example) can be averaged by time integration and can be done electronically with no moving parts. A discontinuous variable must be averaged by computation of discrete values, usually requiring a servo-actuated electromechanical computer.

The *controller,* which operates according to rules of logic, is the control system of most common automatic machines. This device is frequently called a *"control panel."* A simple machine whose operation is dictated by a *controller* is a punch press that won't operate if the blank is not in the correct position, or if someone is in the danger zone. An automatic-assembly machine, for example, requires a complex *controller,* for each part must be inserted in proper sequence, and the position of each part is critical.

Control computer applications

Some machines depend largely on computer control, with only a negligible amount of logic control. Examples of simple computer control are the automatic balancing machines and automatic-sizing devices.

Another example of computer control is the analog controlled lathe, that automatically maintains proper cutting speed, regardless of the radius of the tool position. Control function elements that work by simple equation solving are called *mentors* by some control engineers. This is to distinguish them from the large general-purpose *digital computers,* and the analog differential analyzers. *Mentors* are usually small special-purpose servo-operated electro-mechanical equation solvers, which solve simple relationships of control constants, parameters, and variables.

Mixed control systems . . . Machine "thinking" consists of a very narrow form of reasoning for the sole purpose of making decisions. The scope of the decisions that can be made by a machine is an index of its automaticity. "Machine decisions" are either "logical," or mathematical, or both.

Mathematical machine decisions are not "illogical," and logical decisions can be represented mathematically. In general, however, *logical decisions* are sequential and alternative, according to strict rules. *Mathematical decisions* are based on the continual reconciliation of the constants, parameters, and variables of a process function.

As already pointed out, the control system functional entity that performs logical decisions is a *controller,* though known as a *control panel, timer sequencer* and *programmer.* The control-system functional entity that reconciles control function factors—constants, variables and parameters—by solving the system equation, is a *mentor,* also called an *equation solver* and *control-computer.*

Controllers are commonly used without mentors, though a mentor can play an important role in logic operations. A mentor always demands the service of a controller, for necessary timing, sequencing, and programming on a logic basis.

Logical-mathematical control . . . Most mathematical control systems must have some logical control superimposed on them, for timing, sequencing, and programmnig functions. A *controller* is necessary to provide the switching and sequencing operations used to perform computations from discontinuous data.

The automatic lathe, previously mentioned, is an example of logic circuitry superimposed on a basically mathematical control. Tool engineering practice dictates that for maximum production, consistent with tool life, cutting speed should be kept at a fixed level. The mentor control system takes into account the radius of the tool cutting position, and controls rpm to assure that the desired surface cutting speed is maintained. This is especially important on a facing cut, or taper, where the radius is continually changing. The controller function actuates the mentor as needed, and controls the operational sequence, such as following the predetermined program.

Mathematico-logical control . . . Just as logical *controller* action is at times superimposed on mathematical *mentor* action, mathematical control can support logical control. Automatic assembly by machine usually precludes selective assembly, even though it is known to have some unique advantages. With a mentor, automatic selective assembly is attainable. Assembly-machine control is still largely logical. However, the mentor can be used to select proper parts to make up to the best fit or overall dimension.

Electrodynamic indexing is another example of automatic logical control, complemented by mentor-computer control. In straight mechanical indexing, the stations of the indexing mechanism are fixed by clamps, detents, or stops. Changing the stations necessitates physical changes to the indexer. Physical stops are also subject to shock failure. A mentor evaluates system velocity or rpm and the mass of the indexer stops at the desired positions. To change stations requires only resetting a potentiometer to attain any desired acceleration or braking curve.

What's your question about riveting?

Here are answers to 17 questions most frequently asked about use of small rivets, plus 12 tips on production tieups

By T C Buchanan, chief application engineer, Milford Rivet & Machine Co, Milford, Conn

1—In a consumer product it is impossible to cover up the end of a split rivet. Can it be hidden? Should a compression or tubular rivet be used instead?

Split or bifurcated rivets can be capped. Compression rivets are more costly and will not pierce their own hole as readily as will a split rivet. Tubular rivets can be made so that the head resembles the clinched end, but these also are slightly more expensive than the split types.

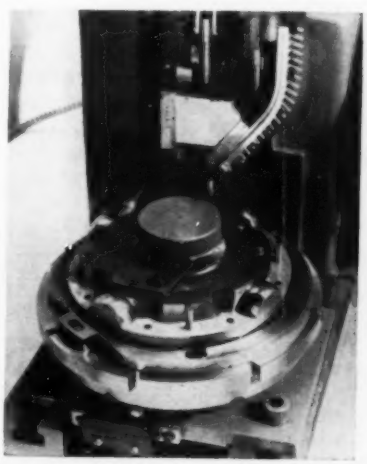
2—Which is better when two rivets must be set in the same part—a single-spindle machine, a double-spindle machine, or a single-spindle machine with slide fixture?

There are a few other possibilities, too: A single-spindle machine with a double head; or one or more single-spindle machines with an automatic indexing or slide fixture.

Each case must be considered on its own merits, but, in general, if two rivets must be set in an assembly, and several parts must be positioned prior to setting either, then it usually pays to set both at once.

Likewise, if the piece being riveted is heavy or awkward, it also is better to set both at once rather than move or slide the piece back and forth. Obviously, a single-spindle machine is less costly than a double-spindle unit . . . a slide fixture is cheaper than multiple spindles . . . and so on.

Complete automation—i.e., rotating tables or in-line transfer devices, with single or multiple machines—is practical when the parts can be fed fast by hand or lend themselves to mechanical feeding, and/or when multiple operations must be performed, and/or when high production rates are required.



Riveting fixture for ball-bearing races. Dial controls action of the machine. Once the cycle is started, the dial automatically indexes, and the machine makes nine joints and stops. Different sizes of dials can be used for different bearings

Slide fixture with special hold-down device depresses the rollpin to provide extra loading room. The fixture slides in and out for loading and unloading, but more clearance still was necessary

3—Suppose the head of machine must practically butt against a wall or bracket in order to obtain the necessary design clearance. Does this mean that the rivet must be placed by hand?

No. The machine can be built to feed from the rear.

4—Machines are designed for a certain setting pressure. What happens if there are variations in the thickness of the material? Doesn't this increase the pressure, and won't it damage the part?

There are several ways to take care of such variations. Machines are available with spring-loaded connecting rods that automatically compensate for variations in material thickness. Or, pneumatic riveters, which provide somewhat of a cushion when setting pressures build up, can be used for the job.

Still another approach is to spec-

Spring pressure or air pressure can be adjusted so that plastic parts can be riveted without breakage. Tubular rivets are employed in this assembly; they are also used in electronic assemblies, instruments, switchgear, toys, and small appliances

In this dial-feed machine, the dial controls the machine (the reverse can be arranged), and the operator controls the loading cycle

What's your question?...

ify a star-set rivet. An excellent example of how star-setting solved a tricky production problem is illustrated by the small circuit breaker produced by Federal Pacific Electric Company. A thickness variation of 0.015-in. in the thermosetting plastic housing often made a difference between a tight and a cracked assembly.

Star-setting required less setting pressure. Furthermore, the individual segments are sufficiently weak to curl over the material without cracking it when the variation is on the high side. If on the low side, it still clinches tight, thus preventing a loose assembly.

Furthermore, a star-set rivet can be knocked out by hitting it with a punch at the center of the peened-over sections. Thus, the circuit breaker can be dismantled for calibration or repair.

5—Will an aluminum rivet function satisfactorily as a pivot?

Many are being used for this purpose. However, it is well to remember that aluminum against aluminum tends to "seize," and that aluminum is basically rather soft in the grades normally used for small rivets. So if loads are high, if the part functions quite frequently, and/or the mating member is also made of aluminum, it may be desirable to specify steel or stainless steel.

6—How can a machine be adapted to various jobs when the raceway must be designed for a rivet of specific dimensions?

By using a riveting machine that can be equipped with quick-change raceways.

7—Can anything be done to make a machine adaptable for riveting inside a deep box section that is deeper than the throat?

Machines can be designed with a hinged bracket that tilts forward to allow the part to be positioned, and then can be tilted back to the normal position for riveting.

In some cases, however, the part can be riveted *before* it is assembled thus eliminating the problem of throat or tool clearances. An example is a fan hub with six blades, with a total of 6 rivets per blade. As originally designed, the brackets were first riveted to the hub, and then the blades to the brackets. Putting the first 5 blades into the machine presented no problem. There was adequate room for maneuvering the part in the jaws. But it was impossible to place and set the last rivet on the last blade. The shape of the adjacent blades was such that they completely covered the last rivet hole and made it impossible to get the jaws and the roll-set arm of the riveting machine in place to do their job. The solution: rivet the blades to the brackets or arms first, and then the brackets to the hub.

It's surprising how often a simple change in methods will solve what otherwise is a difficult or impossible riveting problem.

8—Which is better — counterboring or dimpling—for a flush joint?

It's seldom that the two methods overlap. For heavy-gage metal, the hole usually must be counterbored. For light-gage metal, there isn't sufficient material thickness to permit a machining operation. Besides, dimpling is less expensive.

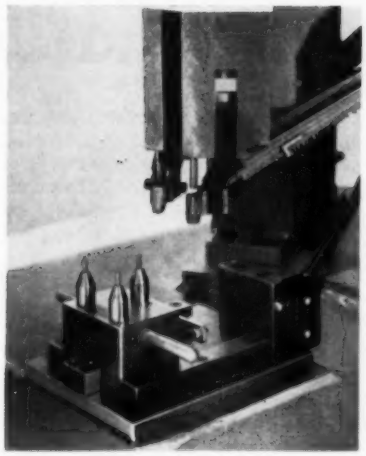
One trick sometimes used on flathead rivets is to form them with a small indent in the head so that they can be drilled out easily if they must be replaced in the field.

9—Suppose that several closely spaced rivets are to be set on a multiple-spindle machine. Would there normally be a hopper for each spindle?

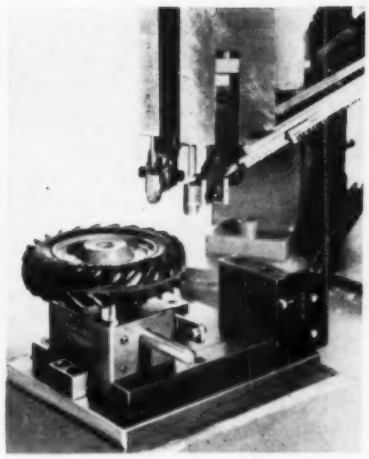
This, of course, depends on the number of rivets involved. Hopper mechanisms can sometimes be made to feed to two or more tracks.

10—Can riveted joints be made air and water tight?

Not without sealing aids, particularly under any pressure conditions. There are many applications that involve riveting through a rubber or composition gasket, either using preformed holes or letting the rivet force its way through the gasket. Before finalizing the design, however, it is wise to check with a rivet manufacturer or to make a pilot run on the application, in order to in-

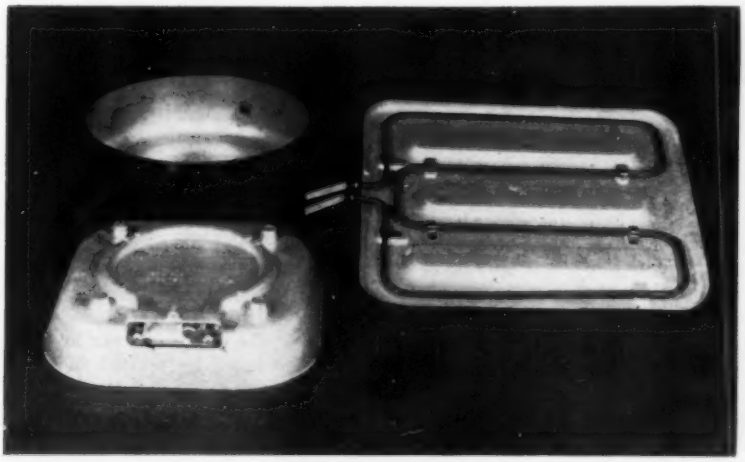


Triple-spindle riveter has a Micro-Switch, which actuates the machine when the slide fixture is in position. All three joints are made simultaneously

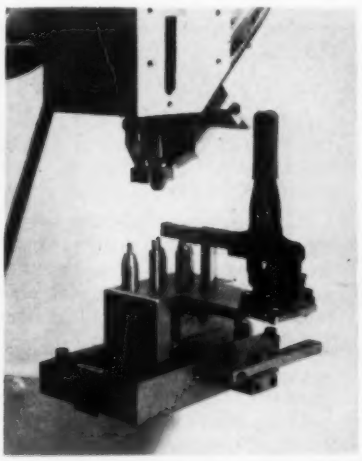


Work in position for the 3-spindle machine. This machine has fixed spacing, but the center distance of many 2-spindle machines is adjustable

Large offset bracket is useful for riveting in hard-to-reach, deep sections. Tools of this type are inexpensive and often developed by the maker for specific jobs



Rivets are used to plug openings in this frying-pan assembly and to fasten brackets



Quick-acting toggle fixture with multiple-position slide is used on a single-spindle machine to rivet magneto parts

sure that a combination of gasket thickness and resiliency does not cause variable setting pressures that result in poor joints.

11—Can nameplates and rating plates be riveted?

Not if the nameplate must be put on after the product is assembled in a housing. Then, the product must be drilled and tapped for a machine screw, drilled and attached with a drive screw, or put on in some other way. But if the nameplate can be attached while the underside of the housing or component is still accessible, riveting can be used and offers the possibility of large cost savings.

12—Can a rivet pierce its own hole?

Within limitations, yes. Applications such as 3 in. and larger vent pipes, roof gutters, down spouts and metal containers of various types can be assembled with machine-fed, special self-piercing split and tubular rivets.

Tote boxes, non-metallic containers and other applications where tempered fiber-board sheets, considerably greater in thickness than corresponding metallic materials, are used can also be riveted with various styles of self-piercing rivets.

Suitcases, boxes, belting and other items made of relatively soft materials can be pierced with standard split or full tubular rivets.

13—How can hardware components such as clasps, hinges and locks be riveted to easily pierced materials like cardboard, plywood and leather without resorting to the use of locating fixtures for alignment purposes?

By using a riveting machine equipped with either a mechanical or a pneumatic-advance jaw slide, coupled with an advanced driveshaft crank, the machine operator can without the aid of any fixtures center a component beneath a rivet.

The advance crank automatically forces the rivet part way through the jaws. With the tip of the rivet shank as a guide, the machine operator lowers the jaws toward the component to a point just above it by partially depressing the clutch-release pedal. Alignment of the com-

What's your question?...

ponent with the rivet can be made quickly by eye, and the machine is cycled by depressing the clutch-release pedal the rest of the way.

14—Many switches, timers, relays and electrical assemblies have components which must be accurately located. How can these parts be quickly and properly positioned for a riveting operation?

Nesting fixtures in most cases provide the answer to this and similar problems.

15—Can a large number of rivets, five or six or more for example, be set at one time?

Yes. A group of almost any number of compact pneumatic riveters coupled with slide, rotary or liner-motion fixtures and controlled by one or two operators can be used on many applications in place of motor-powered, single- and double-spindle riveters, each run by individual operators. This further development of automation in riveting and assembly-line techniques is largely possible because of the availability of pneumatic equipment specifically designed for multi-spindle applications.

Primary limitation is a simple one. Rivets must be all on one or parallel planes.

16—Suppose because of unavoidable design limitations the head of the rivet must be placed on the inside of an assembly. Can this rivet be machine fed and set?

Maybe. If the space restrictions are not too severe, it may be possible to reach the point to be riveted with a machine equipped with an offset driver and jaw arrangement.

17—Most riveting applications require a certain amount of clearance between the rivet shank and the holes in the components to be riveted. What can be done to allow an application to be riveted where little or no clearance is permissible?

Depending on the size and shape of the application, a pressure pad may provide the answer. Many bearings, quality tools, and precision parts can be supported by pressure pads which will allow the rivet head to seat firmly against the top of the assembly before clinching on the underneath side. If a pressure pad is not used, the rivet may lock in the assembly before the head is properly seated.

Production Tipsheet for Rivet Users

1. Check rivet inventory at periodic intervals, concentrating on part numbers as well as on quantities. A shortage of just one type can cause serious production delays.

2. When base materials are made of hot-rolled steel or other metals that may cause severe tool wear, consider use of an insert for the plunger pin and anvil. Inserts, made of high-alloy steel, wear well and can be installed in minutes.

3. If product or model changes are frequent, or if the same assembly areas are used for a variety of products, consider quick-change raceways to adapt your machines to different sizes of rivets. Within the limits of machine capacity, these raceways permit using the same machine for many dissimilar jobs.

4. If an operator must visually align the machine head with a relatively small hole in the assembly, investigate a manually operated machine or an automatic machine equipped with an advanced jaw mechanism, so that the operator can bring the jaws close to the work under complete control.

5. Check the manufacturer before applying a rivet to fragile products such as porcelain or cast plastic. Difference in thickness can cause pressure buildups and consequent breakage during the riveting cycle. A spring-mounted toggle provides equal pressures regardless of variations in materials.

6. For assembling a housing that is subject to removal, consider a star-set rivet that can readily be removed by a punch. Star-setting is also favored for plastic and porcelain parts, among others, since less pressure is required to form the clinch.

7. Investigate multiple-spindle machines when production requirements are high and multiple rivets must be set in the same assembly. If riveting spacing is critical, a single-spindle dual feed machine or a compact pneumatic machine may prove to be the answer.

8. For assemblies subject to electrolytic corrosion, select metals close together in the periodic-activity table. If this is impossible, consider plating or finishing prior to assembly, or the use of a gasket to separate the materials.

9. If rivet splitting is encountered, check tooling and rivet dimensions. Splitting can be caused by impurities in the stock or the wrong temper in the wire. But it also can be caused by a rivet that is too large or too long, by a roll set that is unsuitable for the fastener being used, by incorrect hole size, or by a plunger that has been deformed by heat-treating or wear.

10. If the rivet is not getting through the work, the assembly should be sectioned to determine if the rivet is swelling at the start of the clinch and then locking in the work. If this is the case, and the hole size is correct, it may be necessary to provide a rubber or spring pressure pad around the roll set. This will absorb initial impact and insure proper seating, especially of soft rivets like aluminum and silver.

11. Worn rollsets will cause defective joints. Inspect tools at periodic intervals . . . order replacements ahead of need. If there is a ring around the distorted end of the rivet shank, the tools are worn and should be replaced. If the rivet does not set properly, the plunger pin may be "mushroomed" to an extent that causes locking. If the rivet head is flattened or shows a distinct ring after the rivet is set, the shape of the driver does not properly conform to the head radius.

12. If progressive riveting or assembly is necessary, investigate the possibility of using the first rivet as a locating pin for subsequent operations.

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CITIES SERVICE

QUALITY PETROLEUM PRODUCTS

True-Position Tolerancing—XII

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By Walter H Harrington,
engineering standards coordinator,
Avco Research & Advanced Development Div.
Wilmington, Mass.

There are many designs for interchangeable assemblies requiring parts that have groups of cylindrical or non-cylindrical features which must be located in relation to a datum. One such assembly is the pilot shown in Fig. 37.

In such instances, true-position tolerance applies both to the hole-to-hole relationship and to the pilot-to-hole relationship. The true-position tolerance specified must be maintained only if both the pilot and the hole are at maximum-material condition.

Hole Related to a Datum Feature or Pilot

In Fig. 37, the true-position tolerance indicated by the symbol sets up a bolt hole-to-hole relationship and a bolt hole-to-pilot relationship, and automatically establishes a concentricity between the bolt circle and the pilot hole. Here, the datum feature symbol is used to designate the proper surface from which location of the feature is controlled. The datum-feature symbol warns both manufacturing and inspection that there is a requirement to control the location with respect to a datum which will result in maintaining the positional tolerance between a pattern of holes and the pilot hole.

Fig. 38 indicates that true position is in relation to a common axis. In Fig. 39, true position is in relation to a datum plane or surface.

In Fig. 40, a pattern of holes is located in relation to a pilot hole. Fig. 41 is a typical call-out on drawings for a group of holes using one note only.

Match Drilling and the Transferring of Holes

True positioning applies to all holes required for interchangeability of parts. A close true-posi-

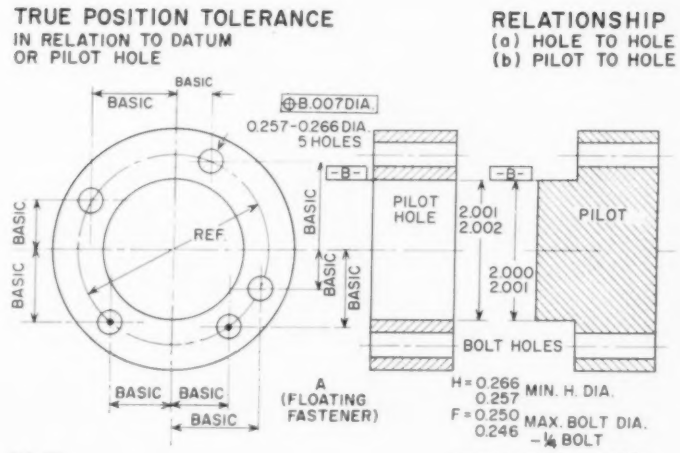
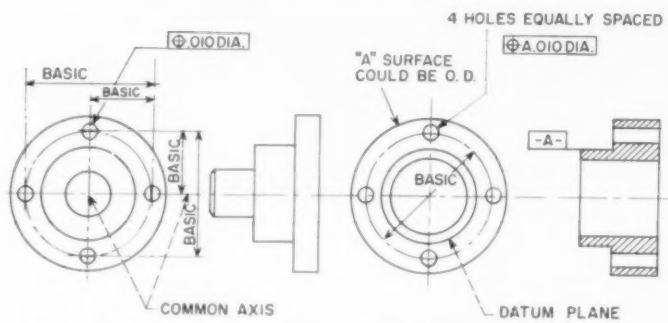


FIG. 37



TRUE POSITION IS IN RELATION TO A COMMON AXIS.

FIG. 38

TRUE POSITION IS IN RELATION TO A DATUM PLANE OR SURFACE.

FIG. 39

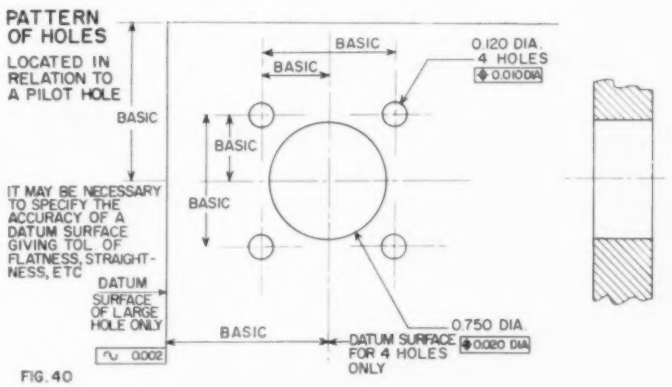
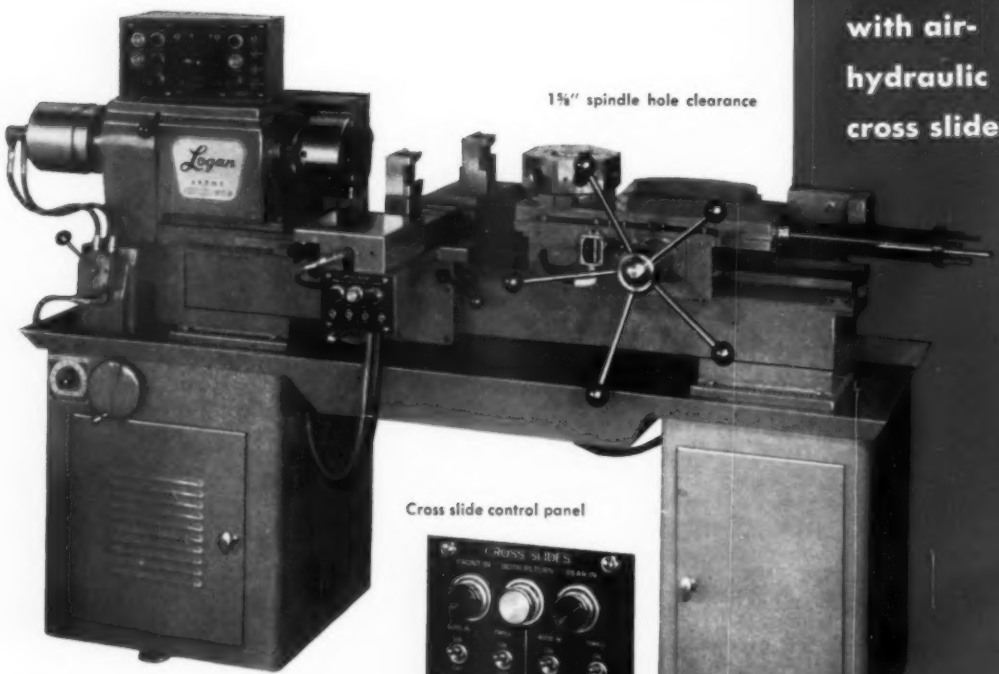

PATTERN OF HOLES
LOCATED IN RELATION TO A PILOT HOLE
BASIC
IT MAY BE NECESSARY TO SPECIFY THE ACCURACY OF A DATUM SURFACE GIVING TOL. OF FLATNESS, STRAIGHTNESS, ETC
DATUM SURFACE OF LARGE HOLE ONLY
∿ .0002
0.120 DIA. 4 HOLES
⌖0.010 DIA
0.750 DIA.
DATUM SURFACE FOR 4 HOLES ONLY
⌖0.020 DIA

FIG. 40

New accomplishment in automation with new **Logamatic**

410

automated turret lathe with air-hydraulic cross slides



1⅝" spindle hole clearance

Cross slide control panel

Spindle and turret control panel

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- Automatic cycling
- Adjustable rapid travel
- Variable-rate turret feed
- Variable-rate cross slide feed
- Variable-speed drive
- Pushbutton control
- Available as bar-feed machine
- L-O spindle nose

Only the Logan Logamatic 410 offers so many features in its price range! Swing over bed, 14⅝". Swing over cross slide, 6⅞". Spindle bearings: (4) ABEC Class 7. Speed range, 25 to 2,000 rpm. Two-speed, 3-1½ hp. Dinabrake motor and controls are standard equipment. Priced at only:

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True-Position Tolerancing—XIII

tion tolerance can be maintained in such instances. However, rather than true positioning of holes to a very fine tolerance, we advise match drilling, transferring of holes, or locating holes at assembly.

Fig. 42 illustrates two dowel-pin holes. We can true position the holes in piece No. 1 and, using this piece as a templet, locate the two holes in piece No. 2. The true-position tolerance must be established by the designer, using his judgment, because no formula can be used in this case.

True Position of Multiple-Hole Operations

In Fig. 43, where there are several cylindrical features on one axis, the true-position tolerance value applies to all surfaces. The counterboring tool automatically sets up concentricity between surfaces with only one position callout being necessary in this case.

True-Position Tolerance Applied to Non-Parallel Holes

Because the tolerance zone established by true-position dimensioning is cylindrical and centered about the basic axis of the holes, this system of tolerancing also lends itself to patterns of holes, such as in Fig. 44, where the axes are not parallel.

Here true-position tolerance controls the angular locating dimensions as well as the linear locating dimensions. But true-position tolerance here also controls the axis of the holes. This means that the axis at all sections along its length must fall within a cylindrical tolerance zone, the diameter of which is equal to the true-position tolerance.

In other words, true-position tolerance controls the amount of

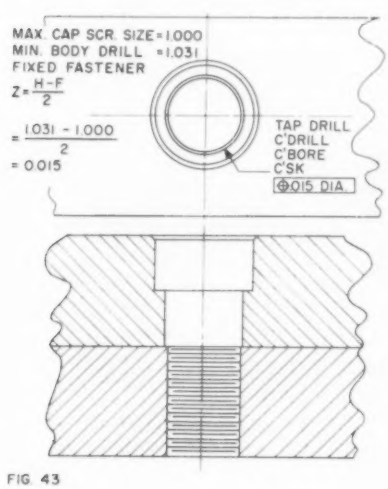

FIG. 43

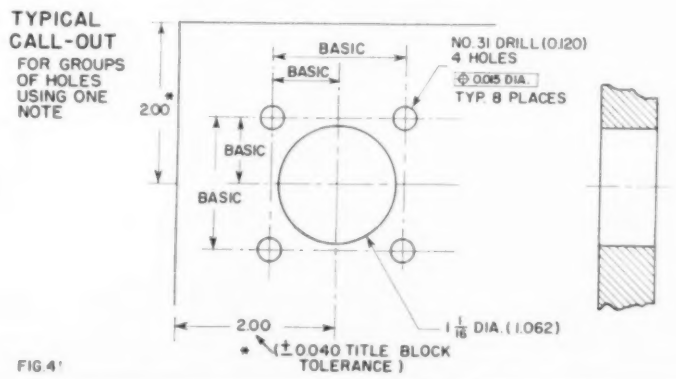

FIG. 41

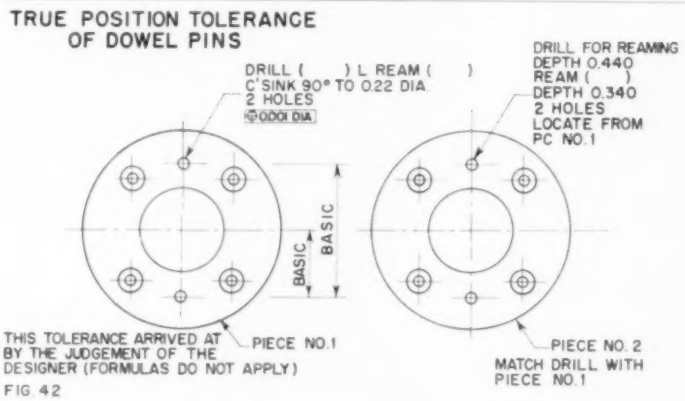
TRUE POSITION TOLERANCE OF DOWEL PINS
DRILL ( ) L REAM ( )
C'SINK 90° TO 0.22 DIA.
2 HOLES
⌖.001 DIA
DRILL FOR REAMING DEPTH 0.440
REAM ( )
DEPTH 0.340
2 HOLES
LOCATE FROM PC NO. 1
BASIC
BASIC
THIS TOLERANCE ARRIVED AT BY THE JUDGEMENT OF THE DESIGNER (FORMULAS DO NOT APPLY)
PIECE NO. 1
PIECE NO. 2
MATCH DRILL WITH PIECE NO. 1

FIG. 42

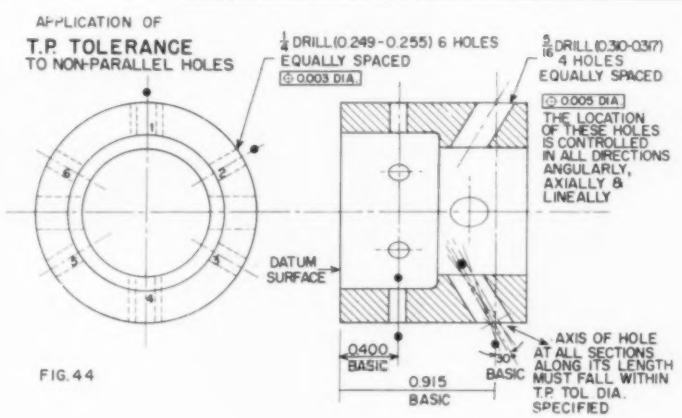
APPLICATION OF
T.P. TOLERANCE
TO NON-PARALLEL HOLES
1/4 DRILL (0.249-0.255) 6 HOLES EQUALLY SPACED
⌖.003 DIA.
3/16 DRILL (0.180-0.187) 4 HOLES EQUALLY SPACED
⌖.0005 DIA.
THE LOCATION OF THESE HOLES IS CONTROLLED IN ALL DIRECTIONS ANGULARLY, AXIALLY & LINEALLY
DATUM SURFACE
.0400 BASIC
30°
BASIC
0.915 BASIC
AXIS OF HOLE AT ALL SECTIONS ALONG ITS LENGTH MUST FALL WITHIN T.P. TOL. DIA. SPECIFIED

FIG. 44

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True-Position Tolerancing—XIV

variation that the hole can run out in its depth; i.e., from one surface location to the opposite surface location.

True-Position Dimensioning of Non-Cylindrical Features

The true-position method of dimensioning is concerned primarily with cylindrical features such as hole patterns or bosses. However, the principles involved are equally applicable to many non-cylindrical features, such as slots, tabs, dovetails and serrations, as will be shown in Figs. 47-50.

The difference between true positioning of holes and slots is mainly in the geometry of the tolerance zone. In true positioning of holes we have a circular tolerance zone, whereas in true positioning of slots we have a rectangular tolerance zone. The axis of the slot that is at maximum-material condition must fall within a rectangular tolerance zone.

In terms of the positioning surfaces of the slot (Fig. 45), all points of these surfaces shall be on or outside of a positional zone whose sides are parallel to the true-position centerline and are spaced apart by an amount equal to *the minimum width of the slot minus the true-position tolerance.*

In Fig. 46, the axis of a slot which is at maximum-material condition (slot with minimum width) must fall within a rectangular tolerance zone which is symmetrically disposed with respect to the geometrical position by the amount of the true-position tolerance. *The total width of the tolerance zone is equal to the true-position tolerance.*

In Fig. 47, the tabs are located by a basic dimension of 30°, but their centers must be held to within a 0.010 in. total-indicator-reading, true-position tolerance. The mating tabs must also be located and true-position toleranced in the same manner in order to assure interchangeability.

To be continued in an early number

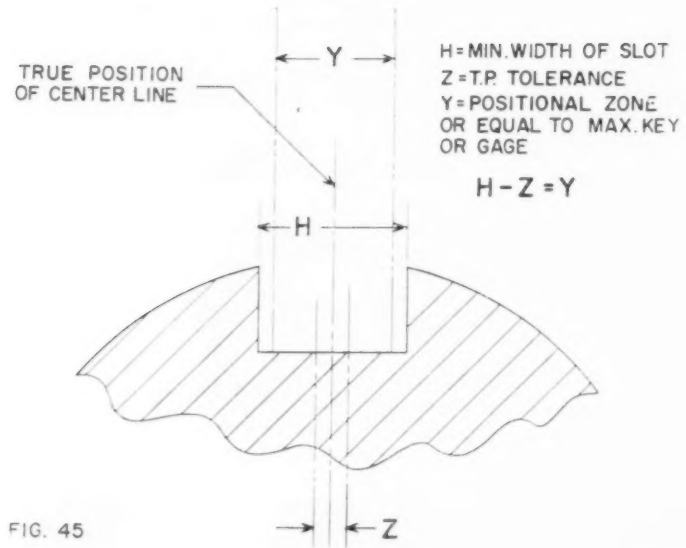


FIG. 45

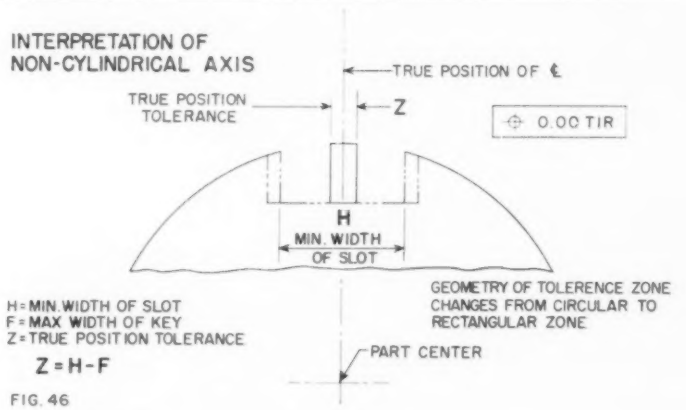


FIG. 46

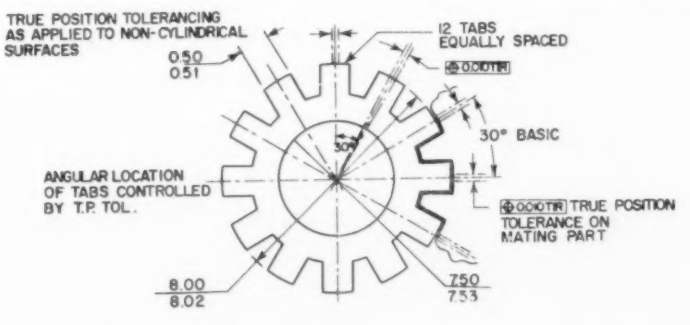


FIG 47

YESTERDAY'S PIONEER . . . TODAY'S LEADER

WELDON / HOLDERS

FOR END MILLS

Regardless of the type or size of Straight Shank End Mills used the best results are obtained by the use of Weldon End Mill Holders and Adapters. They are manufactured of finest quality material to a high degree of accuracy to assure concentricity of the cutting tool together with maximum holding qualities.

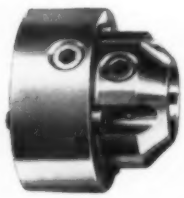
Holders carried as stock items to serve end mill shank diameters 3/16" to 2" inclusive.

Weldon holders are used on all makes and types of milling machines and boring mills having National Standard Non-Sticking Tapers or the Brown & Sharpe or Morse type of tapers.

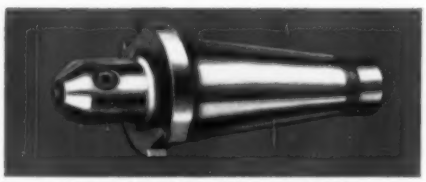
NATIONAL STANDARD TAPERS

QUICK CHANGE ADAPTER AND HOLDERS

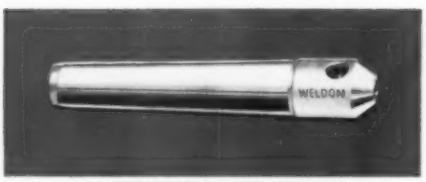
2-SCREW DRIVE HOLDER
NATIONAL STANDARD TAPERS



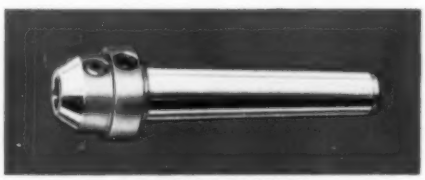
HOLDER WHICH DIRECTLY BOLTS ON STANDARD MILLING MACHINE SPINDLE. DRIVEN BY KEYS ON SPINDLE NOSE



SINGLE SCREW DRIVE HOLDER
NATIONAL STANDARD TAPERS



SINGLE SCREW DRIVE HOLDER
BROWN & SHARPE OR MORSE TAPERS

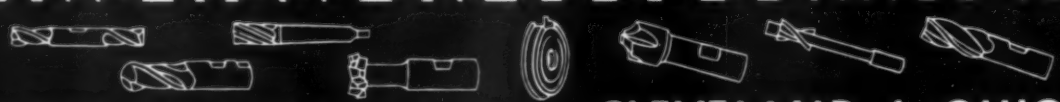


2-SCREW DRIVE HOLDER
BROWN & SHARPE OR MORSE TAPERS

Catalog list numbers are now marked on all Weldon tools and holders as an aid when reordering . . . another WELDON FIRST.

Weldon distributors throughout U.S.A. and Canada carry complete stocks to serve you.

THE WELDON TOOL COMPANY



3000 WOODHILL ROAD · · · CLEVELAND 4, OHIO

Talking Shop...

Saved $108,000

EVER HEAR of saving $108,000 on a tool-grinding setup? GE's jet-engine department at Evendale, O, did it, partly because the old setup was so bad and partly because everyone knew something had to be done, so there was full cooperation on the new layout. It used to take as much as a half hour wait even for emergency tool regrinding, plus a lot of traipsing around between a tool crib, a cutter crib, and an inspection station. Many tools had to be farmed out for regrinding.

Solution was a central tool reworking crib with a foreman, two new grinding machines, and a comparator. The move reduced tool inventory and now provides 1-day service on all tools. They need it, too, because they're machining high-temperature metals and even carbides don't last long.

Suspended Furnaces

WITH AN AUTOMATED FURNACE line for heat-treating operations, designed to run at a particular production rate, cutbacks in production can pose a problem. At one of the automotive plants this has been done by suspended carburization. At night and on weekends the furnace temperatures in the line were reduced and the conveyor stopped. Furnaces are brought back to operating temperatures so that each reaches this temperature as the conveyor cycle is resumed. Some case diffusion will result from this procedure, so it is best to run on the low side of the case tolerance when the cycle is to be suspended. Hole shrinkage will also be greater than it usually is, presenting a production problem in subsequent honing operations. The method is good for emergency use under normal production loads—when there is a power failure or a conveyor breakdown. Before adopting suspended carburizing cycles, your metallurgists should make some tests at various holding temperatures and times to determine satisfactory schedules and develop a time schedule for cutting and raising furnace temperatures. At the start of suspension, the furnace system should be purged with nitrogen, both to stop the carburizing cycles and to avoid danger of explosion.

Listening Computer

A CONTROL that can respond to written instructions, written in English rather than in code, has been developed by the Air Force and Remington Rand. The gadget has the imposing name of Air Materiel Command Automatic Compiler or AIMACO. The machine initially has a vocabulary of 30 verbs, but with space to enlarge the vocabulary as required. Two big advantages are expected to be a reduction in the time required to program a computer and in the time required to train people to write programs. We're impressed, but the fact that the vocabulary is limited to verbs (a reasonable one, actually) raises the frustrating possibility that an annoyed operator can tell the machine to *go* but not to *where*.

New Surrey

ONE OF THE 1959 cars will be a version of a 1903 automobile, combining a steering tiller, brass headlights (with sealed-beam inserts), and wooden spoke wheels. A full-scale model of a car of the early 1900's, with such modifications for modern legality as turn indicators, the survey will be sold for $1095 by Dyer Products Co in Canton, Ohio. E W Bliss in Canton is building the car for Dyer.

MEMOS

by BESS RITTER

The reason a monkey-wrench bears this name has absolutely nothing to do with monkeys at all: Instead, it was named after the London blacksmith who invented this tool. His name was Charles Moncke, and at the beginning the wrench was known (logically) as Moncke's wrench. In time this was slurred into "monkey wrench" by machinists who used it but had never heard of Mr. Moncke.

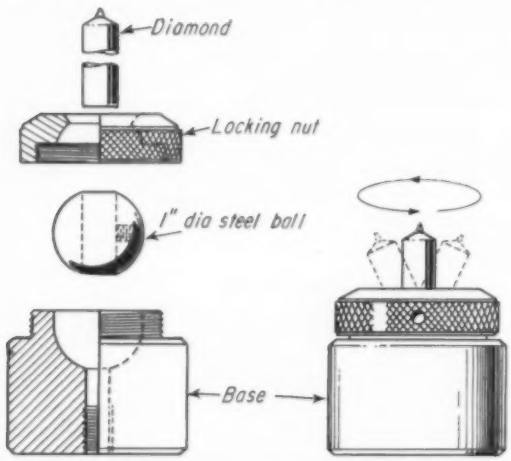
In the 15th century Italians actually swallowed small silver coins for the very same reason that modern Americans swallow special pills from the drugstore—to aid poor digestion and cure stomach ills. Silver dust and silver shavings were also mixed with foods, as the metal in this form was supposed to aid the appetite.

In Poland it's very bad for the crops to try to work the ground with an iron ploughshare. It must be made of wood, and the reason for this dates back to those times when iron ploughs were first introduced to the superstitious farm folk there.

The harvest was fine the year before the iron plough appeared. However, the year it was first used happened to be a bad one for the crops. The next year was also bad, and so was the third. This was sufficient proof to these farmers that the fault was due to the new iron ploughs, and this superstition has persisted for many years.

Practical Ideas...

Swivel Diamond Holder Dresses Grinding Wheels Better



When this holder is set and used in all of its many possible angles, it will present a sharp diamond edge indefinitely, in fact, as long as there is a piece of diamond left in the shank. The result is that the diamond will last longer because of the reduced friction; something to be taken into account from the economical standpoint. Another and more immediate benefit is that a better dressing job is done when the diamond is sharp.

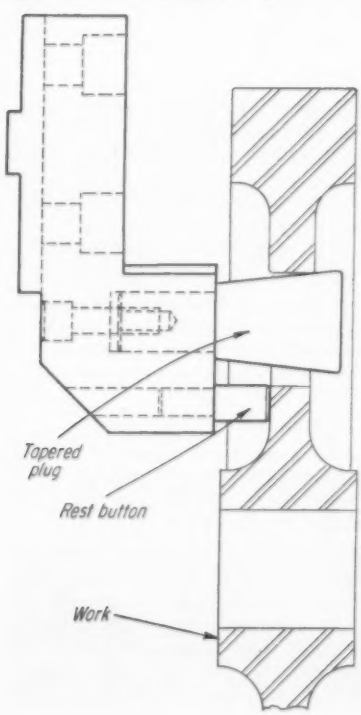
The diamond should have a good cutting edge when new and is therefore mounted perpendicularly in the holder. But as the point dulls, various angles are used to get the best edge to the wheel. But, whatever angle is used, the diamond must always be inclined with the rotation of the wheel or the diamond will be drawn into it.

Construction should begin with obtaining a suitable steel ball. I used a 1-in. ball, annealed it and drilled and reamed a ⅜-in. hole through its center. A 10-32 tapped hole enters the ⅜-in. hole and receives a setscrew. The base is then machined with an internal ½-in. radius and a through hole to the bottom to take a plug and setscrew for locking the ball at angles if needed.

The top of the base is threaded to match the threads in the cap. A 13/16-in.-dia hole through the cap is also machined to a ½-in. radius on the face that contacts the ball. The outer end of the hole is bell mouthed to provide diamond-shank clearance. Two holes are drilled into the knurled OD of the nut for a spanner wrench.

Frank Keesaw, Oakland, Calif

Special Chuck Jaws Speed Gear Machining



Where large gear blanks have to be machined, production costs can be effectively reduced when many operations are done in one setup.

A simple way to do this is illustrated in the sketch at left. Here a gear blank is not only bored and faced, but also completely machined on the back faces of the hub and rim as well as the OD. Thus, second operations are eliminated, cutting handling and setup time.

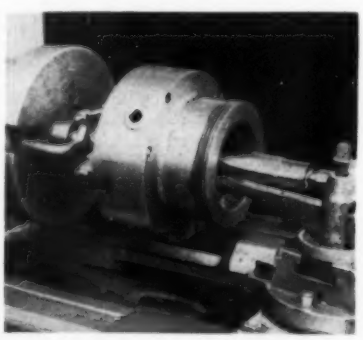
A set of three chuck jaws is made as shown. Each jaw is fitted with a tapered plug, secured with a capscrew and a rest button. When a gear blank is placed over these plugs through the rim reliefs they are drawn up against the rest buttons as the jaws are spread.

The plugs and buttons should be hardened, but as there is no wear on the jaws themselves they can be left soft.

Roger Isetts, Kenosha, Wis

Chuck Trued with Aid of Mandrel

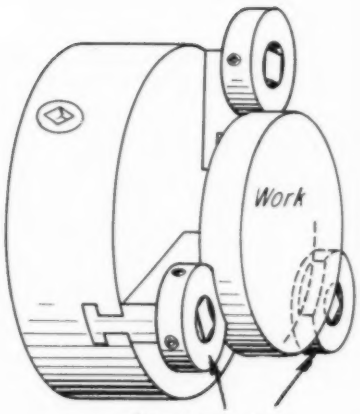
It sometimes becomes necessary to take a small true-up cut in the tapered bore of a chuck adapter for an American standard taper spindle nose. Whatever method is used to set up the work, trueness with the chuck jaws must be maintained.



The job can be greatly simplified with the illustrated setup. A parallel-ground hardened-steel mandrel supports the chuck during machining. The jaws of a self-centering chuck grip the mandrel which is then mounted in the lathe between centers.

After a boring tool has been mounted in the toolpost, fine cuts are carefully taken until the bore is trued. Thus, corrections for jaw and scroll wear are obtained with little effort.

H J Gerber, Stillwater, Oklahoma



Heavy Washers On Chuck Jaws Grip Work for Accurate Turning

Because the jaws in a three-jaw chuck are seldom true enough to hold a workpiece absolutely concentric you have to resort to some gimmick to overcome this fault. Standard jaws are easily ground true, but when the work diameter is so large that the inverted jaws must be used you are faced with a different problem.

The illustration shows the method we use when concentricity with the OD, as well as when parallelism with the back face, must be held to close limits. We use this method when we have to do secondary operations, or when quantities are large enough to be called production jobs. Yes, it has even paid us to employ this setup when we had to machine but a few pieces that demanded extreme accuracy.

Three thick steel rings are secured to the horns of the inverted jaws by means of three setscrews in each. One screw clamps against the back of the jaw while the other two clamp against the sides. Before the setscrews are set up tight, the jaws are tightened very hard on a piece of stock to impress them into the bore of the rings.

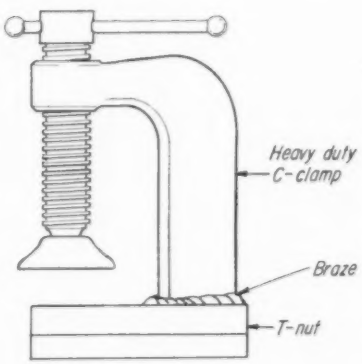
While a disk, a bit smaller in diameter than the workpieces, is chucked on the inside edge of the rings, a recess is machined to the same diameter as that of the work. The disk is then removed and the work is inserted and gripped as it rests in the bottom of the recess.

Walter Gerstel, Berkeley, Calif

T-Slot Clamp Works Where Ordinary Straps Fail

Where no great clamping pressure is needed this clamp will do a good job of holding work on T-slotted machine tables, rotary tables, or face plates. When the work is located so close to the edge of the table that straps cannot be used because there is no room for a heel, this clamp is invaluable. It speeds setups and holds work firmly enough for drilling, milling, and light planing operations.

A T-slot clamp is made by first cutting off a heavy-duty shallow-throat



C-clamp as shown. The section containing the clamping screw is then brazed to a T-nut. This nut is made a little longer than a standard nut from a piece of steel that can be hardened. Hardening is done after the brazing is completed, while the nut is still hot.

The clamping screw can be left as is but can also be cut down if found to be unnecessarily long when clamped on heavy workpieces.

John Dodd, quality control & prod engineer, Chrysler Corp—Missile Div, Warren, Mich

Abrasive Adds Bite To Wrench

When the hex socket in a setscrew or socket-head capscrew is worn to the point where the wrench slips out, some abrasive grit added to the wrench will usually improve the grip.

The grit is applied to the wrench by first coating the end with oil and then dipping it in grinding dust found around any tool grinder. This, in addition to providing a better grip, adds to the dimensions across the flats of the wrench. Screwdrivers can also be made non-slip by the same method.

(Note: Do not use this trick where there is a chance of the abrasive getting into contact with bearing parts, unless you can be very sure that all particles can be removed. Ed.)

Felix Moninski, Southbridge, Mass

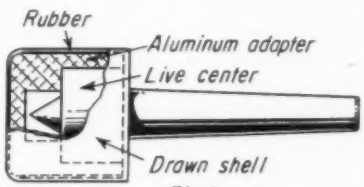


Fig. 1

Live Center Aids Buffing Job

We recently had a number of drawn shells to buff before plating. To simplify this job, we took a ball bearing (live) center and fitted it with an adapter to hold the shells. This made the necessary rotation of the shells easy, and with a little experimentation we soon found the right angle at which to hold the center for any revolving rate desired. Both side and top were in this way buffed without stopping or handling.

The adapter, which was pressed over the bearing housing, was machined from a piece of aluminum. Clearance for the center point was bored as shown in Fig. 1 so that the shoulder rests on the face of the

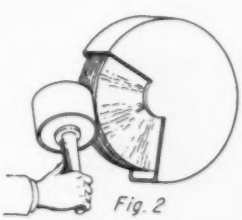


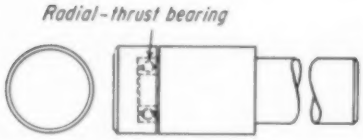
Fig. 2

housing. The concentric OD of the adapter was made ¼ in. smaller than the ID of the shells to provide for ⅛-in.-thick rubber cemented onto the adapter.

Fig. 2 shows how the center with a mounted shell is held against the buffing wheel. For slower rotation, the axis of the live center is swung towards vertical.

H Koslow, Bronx, N Y

Practical Ideas...

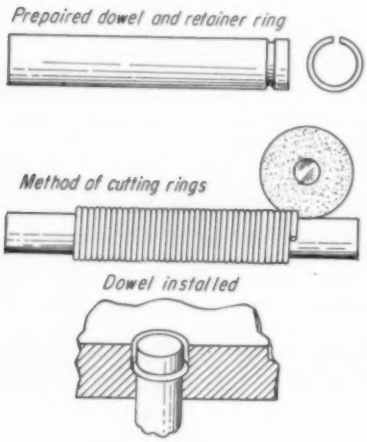


Live Stop Speeds Work

This is a flat live stop which is used in the hex turret of our turret lathe. It serves to gage the length of the bar stock being fed through the lathe spindle, allowing work to be located without stopping the machine.

One end of the stop is machined to fit a station in the hex turret. The other is turned to a light press fit into a radial-thrust bearing. A cap to cover the bearing and to provide a striking surface, is bored to lightly press over the bearing.

C M Binggelli, Fulton, Miss



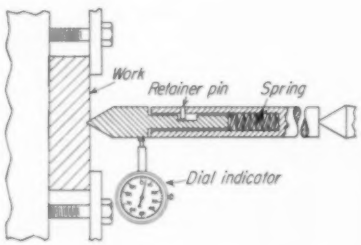
Dowels Substitute For Punches

I recently had to construct a perforating die designed to produce 100 ⅜-in. holes through light sheet metal. Commercial punches for the job would have cost at least $120, had they been available at the time. But because they could not be had on short notice, I substituted ⅜-in. dowel pins in place of regular punches. This, in addition to being an expedient solution, showed off a big saving in material cost, as we paid only $12 per hundred dowels.

The dowels were prepared by cutting a ring-retainer groove with a cutoff wheel at identical distances from one end of the pins. Retainer rings were made by wrapping music wire, of a diameter to fit the groove, around a mandrel and parting them into individual rings with a cutoff wheel as shown. The total time consumed for these operations was 3 hours.

After the punch plate had been drilled, reamed, and counterbored, the pins were inserted and ground flush with the back of the plate. 50,000 screens have so far been punched with this die and it looks good for many more.

George Kelly, Philadelphia, Penna



Centering Rod Locates Work

A simple but effective instrument to accurately locate work on the lathe faceplate is shown in the above sketch. It is a spring-loaded center finder used in conjunction with an indicator.

Once the work has been laid out, and the intersecting lines center punched, it is strapped to the faceplate with the punch mark centered as nearly as can be estimated. The point of the finder is then nested in the punch mark while the other end is seated on the tailstock center. Bringing an indicator into contact with the finder, near its pointed end, will show up the slightest runout which is then corrected by tapping the workpiece sideways.

The center finder is made of two pieces of drill rod. One end of the longest piece is accurately center drilled, while the other end is concentrically drilled and reamed to receive the point shank.

The shorter piece is then turned to a 60° included-angle point, and with a shank having a sliding fit in the reamed hole. A short slot is milled in the shank to receive a retainer pin. After a light compression spring has been dropped into the bore, the two parts are assembled and locked together with a retainer pin.

Howard Levy, Brooklyn, N Y

ERNEST JONES
Bronx, NY

won $25 in addition to regular payment for their ideas:

CASTERS EASE
DRUM HANDLING

In the July 28, 1958 issue

An extra $25 will be paid for the best Practical Idea in each issue of *American Machinist*. Selection of the winner is made by a group of our readers.

Our annual Production Planbook will reprint all winning ideas as a review. One will be chosen out of this issue as a winner of winners, and will receive a

GRAND PRIZE OF $100.

JUDGES—A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical idea. If at any time their votes result in a tie, $25 will be paid to each co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer, or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co, Inc, and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER — Send all entries to "Practical Ideas Editor," American Machinist, 330 West 42nd St, New York 36, N. Y.

New Shop Equipment
Materials and Parts

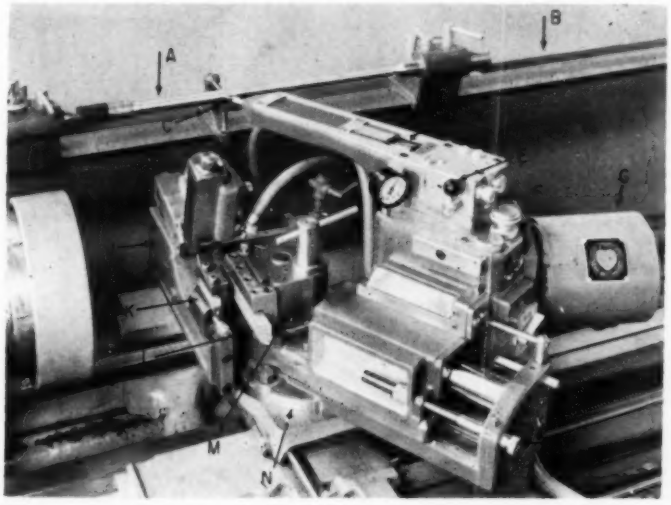


Fig. 1—Tracer unit can use a sample stepped shaft for a templet. An adjustable eccentric (not shown) is supplied on tailstock center for templet, for use at start of cut to prevent tool from running into the lathe's tailstock center. Tracer parts are:

A—Templet, round or flat; here, a sample stepped shaft
B—Templet rails furnished in any length
C—Tracer
D—Micrometer adjustment for size
E—Control knob to start or interrupt cycle
F—Adjustable feed-rate valve for non-tracing work
G—Self-contained fractional-hp motor and pump
H—Positive stop allows turning without templet
J—Roller-follower rest attachment
K—Turning tool in advance of rollers
L—Tracing tool
M—Leland-Gifford toolpost for preset tools
N—Swivel for turning or boring

Hydraulic Tracer Attachment Cuts Time 90% On Turning, Boring and Facing

A self-contained hydraulic tracing attachment replaces the regular compound slide, can be used to turn stepped or contoured shafts and to face and bore castings with internal steps and contours. The device costs a fraction as much as a tracer lathe.

An accuracy of 0.001 in. and better is possible, because the hydraulic circuit and slide will respond to a stylus movement of a few hundred thousandths.

The tracer attachment can be applied to engine lathes, turret lathes, high-production lathes, special lathes to swing jet-engine parts, and even to stations of an indexing-type machine. If used with a turret lathe, the attachment will do much of the work now ordinarily assigned to program control devices.

To mount the tracer unit, it is necessary only to remove the standard lathe compound slide and in its place mount the tracer attachment. Templet rail-support brackets are mounted on the bed in such a manner that the full swing and traverse are still available. Templet holders accept round or flat templets.

In operation, the tracer stylus and tool approach the cuttting position in rapid traverse. Longitudinal feed is engaged and the tracer stylus controls tool position accurately to the end of the cut. Square-shoulder jobs are no problem, because with the

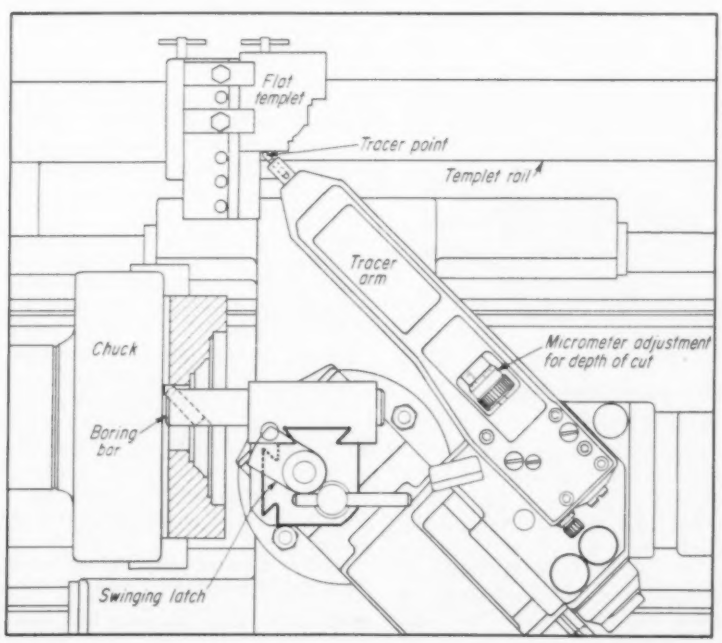


Fig. 2—Steps are positioned within 0.001 in. when boring castings about 10 in. dia and having 5 steps and a contoured section. Quick-change toolblock holds preset tool (turning or boring) against a solid face. Swinging latch clamps boring-bar holder against upcut on rear of internal contour. With toolpost for interchangeable bar and toolholders, holders are pulled against positive shoulders to obtain maximum accuracy and firmness of tool location

swivel set at 60° to the work axis, it is possible for the tool to fall 30° (60° included angle) and rise at 90°.

Three sizes of the tracer unit are available: No. 1—fits lathes from 14 to 16 in. swing; No. 2—fits lathes from 16 to 20 in. swing, and No. 3—fits lathes from 20 to 27½ in. swing.

The roller follow-rest attachment for the tracer unit is helpful on most bar work, and permits use of carbide and ceramic tools to full capacity on slender work. This rest is quickly removed. By turning with the auxiliary tool in advance of the rollers, the work surface is made concentric with the centers and also smooth. Under these conditions the rollers give maximum support to the work; pressure on the centers is reduced. A rough hot-rolled bar can be finish turned in one operation.

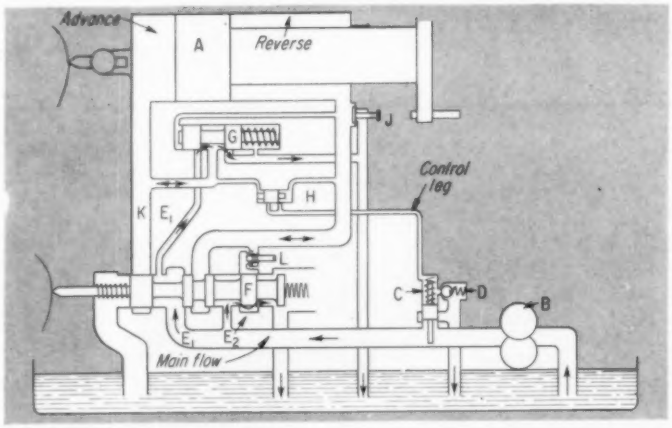


Fig. 3—Hydraulic circuit for tracer unit prevents hunting of tool if movements of the tracer are in small increments

Functions of Hydraulic Circuit

Precision in tracing or boring is maintained at any tracing speed from 0 to 40 ipm. The hydraulic circuit is of the non-hunting type. Piston *A*, Fig. 3, is fixed. Oil is supplied by pump *B* driven by a fractional-hp motor. Delivery pressures range from 150 to 400 psi, according to the demands of the cut. Most of the time, the pump is not required to operate at peak pressure.

Other elements of the hydraulic circuit are: two-stage pressure regulators *C* and *D*, the branch circuits E_1 and E_2, the shuttle valve *F* actuated by tracer movement, spring-loaded control valve *G* that maintains 100 psi on the reverse side of the cylinder, valve *H* to supply oil to regulator *C*, adjustable orifice-check valve *L*, main flow leg *K* to advance side of cylinder and unloading valve *J* which is tripped when the slide is returned to the out position, thus removing pressure from the system.

At rapid advance to the work, the shuttle valve *F* is at far left, uncovering the main port to oil line *K*. Full flow of the pump advances the slide at 65 to 135 ipm, depending on size of unit.

While tracing is in progress, the port mentioned is closed, and oil flows to circuit legs E_1 and E_2. Leg E_1 supplies oil to a port in valve *G* and then to supply line *K* to apply pressure to the advance side of cylinder. Leg E_2 leads to orifices in a land on valve *F*. The orifices provide a "permanent leak" of approximately 25% of pump capacity and are a control feature. Leg E_2 also supplies the main circuit to the reverse side of the cylinder.

The tracer stylus is pressed against the templet by a spring behind the shuttle valve *F*, the pressure being about 1 lb.

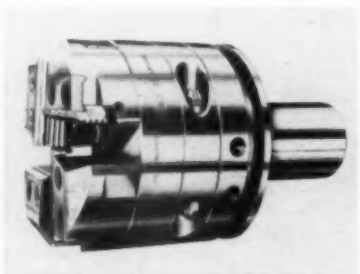
Suppose that the templet calls for an increase in diameter: the tracer pushes the shuttle valve *F* to the right, allowing oil to flow to the reverse side of the cylinder. The rise in pressure here is transmitted to the spring-loaded valve *G*, which is set to maintain pressure at 100 psi. Movement of valve *G* to the right closes the supply to the advance side and allows oil to bleed to the sump. The tool backs away until the stylus stops outward travel.

If the stylus moves toward the work, the flow of oil to the reverse side of the cylinder is restricted, the pressure on the advance side is increased, and the tool moves inward until the stylus stops.

If tool pressure increases, as in a change from a light to a heavy cut, but without stylus movement, the tendency is for the tool to back away. However, shuttle valve *F* does not change position because there is no stylus movement. The "backing away" effect drops the pressure on the reverse side of the piston. Valve *G* now moves to the left, admitting more oil from leg E_1 to circuit *K*. Thus, pressure is increased on the advance side to keep the tool at the correct position.

Leland-Gifford Company, Worcester, Mass

MORE DATA? Circle 51, inside back cover



Revolving Die Head Features Increased Rigidity

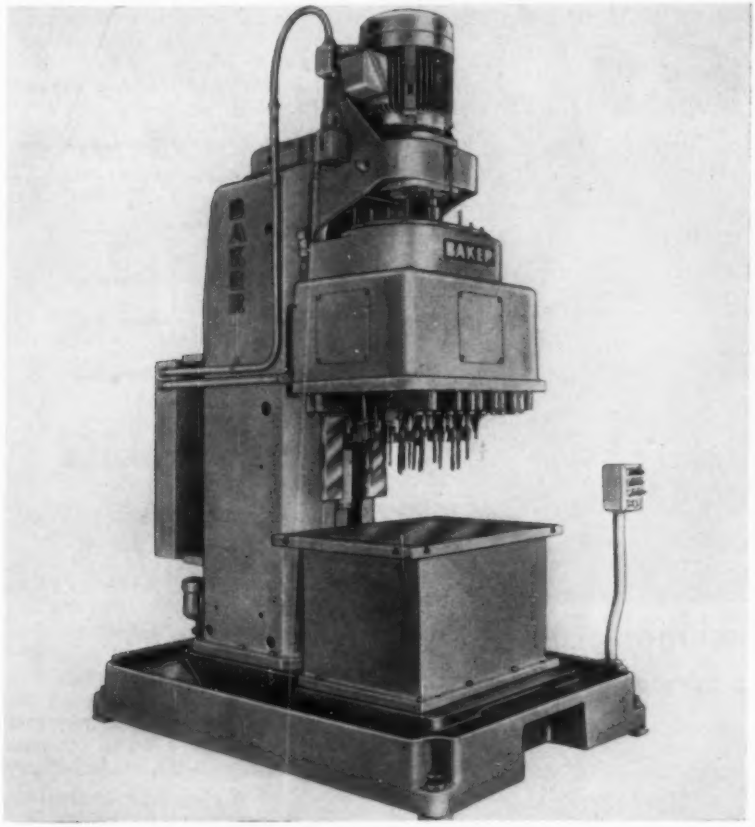
The yoke-operated JN Landex revolving die head is used on automatic screw machines and other machines employing a live spindle. It differs from the JX style, previously offered for these applications, in that it does not incorporate a "floating" mechanism. The "floating" feature allowed a centering action between the die head and the workpiece in the event of misalignment. The trend toward higher spindle speeds has proven this feature inadequate.

Elimination of the float and the reduction in the number of components have enchanced the wearing properties and increased the rigidity of the die head.

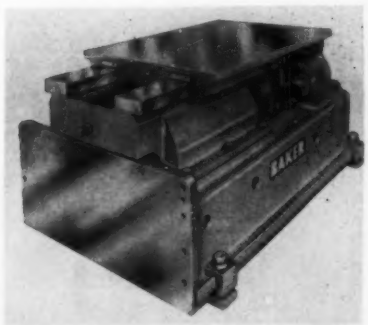
Recommended for commercial threading, the head is available in four sizes—½, 13/16, 1¼ and 2 in., having standard ranges of No. 4 to ½, No. 4 to 13/16, ¼ to 1¼, and ⅜ to 2 in. respectively. All can be equipped with oversize chaser holders for threading above the standard ranges.

Landis Machine Co, Church and Fifth Sts, Waynesboro, Penna

MORE DATA? Circle 52, inside back cover



Vertical machines are available in 7½, 15 and 30-hp models. Stroke is either 18 or 27 in. Wide selection of heads available, both fixed and adjustable



Bare horizontal units are available in way widths of 12, 18 and 24 in. Standard strokes are 18, 27 and 40 in.

Baker Introduces Line of Vertical and Horizontal Drilling and Tapping Machines

This completely new line of hydraulic machines includes both vertical and horizontal drilling and tapping machines. Each type is available in the capacities and with the interchangeable drilling heads necessary to meet nearly every production need. Heavy emphasis has been placed on the interchangeability of components and spindle heads. For the basic machines, a total of 21 different sizes of adjustable spindle heads are available. Fixed center heads, with standard housings and gear trains, and spindle locations custom-bored to fit the specific job, are available in approximately 27 different models.

In addition, there is a choice of six power index tables, in sizes to 60 in. in diameter. These tables can be mounted directly on the machine bases.

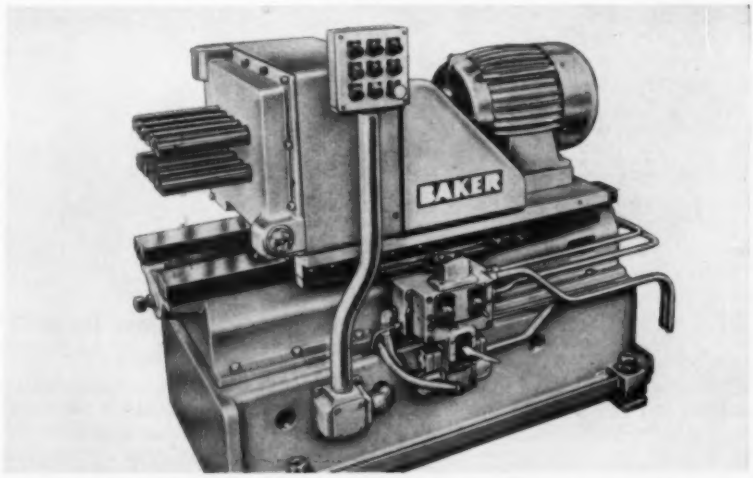
Vertical machines are available with way widths of 12, 18 and 24 in., for 7½, 15 and 30 horsepower, respectively. All are supplied with either 18- or 27-in. strokes.

The horizontal units can be fitted with any of the heads, fixed or adjustable, that are available for the vertical units. Bare horizontal units are also available, in way widths of 12, 18 and 24 in. Each of these is standard with 18-, 27-, or 40-in. stroke.

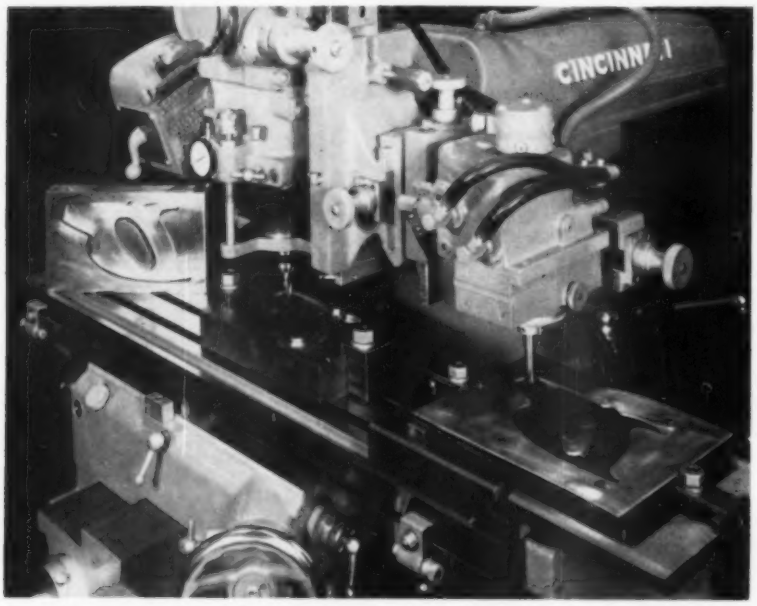
The machines are designed for full flexibility and minimum retooling costs. In addition, they are designed to provide the easiest possible maintenance and greatly reduced parts stocking requirements. The hydraulic cylinder is easily removed; saddle and ways are well lubricated; the base has a coolant and sump pump and has a large capacity chip trough. All electrical and hydraulic controls are located on the outside of the machines for full accessibility. All units in the line meet both JIC and NMTB standards.

Baker Brothers, Inc, 1000 Post St, Toledo, Ohio

MORE DATA? Circle 53, inside back cover



Horizontal machines accept the full selection of fixed and adjustable heads that are available for the vertical units. The hydraulic control panel has graduated dials for setting of feed rates. A manual control is provided for setup operations



Tool and Die Milling Machine Features 3-D Hand-Guided Hydraulic Tracer Control

The Contourmaster 1C is equipped for three-dimensional hand-guided hydraulic tracer controlled milling. It retains the basic advantages and design features of the earlier 1A and 1B machines. The principal difference is in the type of tracing equipment—vertical automatic depth control to the spindle for the earlier models; 3-D hand-guided tracing for the 1C style.

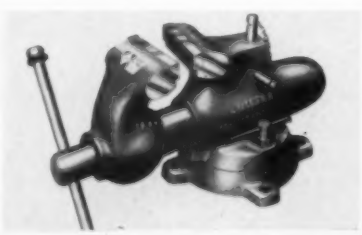
The new 3-D unit controls the direction of traverse of the table and saddle for 360° horizontal profiling, and the vertical movement of the spindle quill for vertical profiling. Deflection of the stylus results in a corresponding movement of the table, saddle and spindle quill, separately or in unison. Maximum horizontal feed rate is 25 fpm. When the tracer and quill are retracted, a rapid traverse rate of 50 ipm is available for positioning the table and saddle. The conventional handwheels can also be used for positioning.

Four distinct combinations of feed movements are possible: (1) all three movements active for complete 3-D control; (2) vertical movements blocked out for 360° profiling in a horizontal plane; (3) cross feed blocked out for depth control milling, using vertical feed and table feed; and, (4) table feed blocked out for depth control milling, using vertical feed and cross feed.

Power feed in a straight line, using the table or cross traverse, can be engaged without constant hand deflection of the tracer finger. In one setting, the full 22-in. table travel and 10-in. cross travel can be used for 360° hand-guided profile milling cuts. Ram mounting of the spindle carrier permits the milling of work wider than 10 in. in two settings. Other features include a 1-hp spindle drive motor, spindle quill travel of 3½ in., and eight speeds from 215 to 5650 rpm.

Cincinnati Milling Machine Co, Cincinnati 9, Ohio

MORE DATA? Circle 54, inside back cover



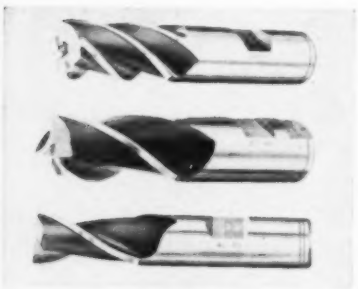
Swivel Jaw Vise Clamps Tapered Or Irregular Workpieces

Back jaw of this swivel jaw vise is on a pivot. A pin holds it in place for straight clamping action; with the pin removed, the jaw can be pivoted right or left to lock angular workpieces securely in place.

The vertical locking pin is easily removed by inserting a drift pin in the horizontal relief hole. Both pins are supplied with the vise, and are connected by a strong chain.

Wilton Tool Mfg Co, Inc, Schiller Park Ill

MORE DATA? Circle 55, inside back cover



Standard End Mills Can Cut 30-50 R_C Materials

The series 30-40 and 40-50 end mills are made of high cobalt-and-vanadium-alloyed steels. Designed for high speed machining of tough-to-cut, high-strength and heat resistant metals, both series offer selections of end mill styles and sizes required for cavity milling, slotting, elongating, surface milling, spotfacing and counterboring.

Illinois Tool Works, Illinite Div, 2501 N Keeler Ave, Chicago 39, Ill

MORE DATA? Circle 56, inside back cover

Sheffield Introduces Cavitron Bench-Type Ultrasonic Machine

Model 200-B2 ultrasonic machine tool has an effective machining area ranging from 1/64 to ½ in. with solid tool design, and additional machining area to 1 in. when used for shallow drilling. The machine re-

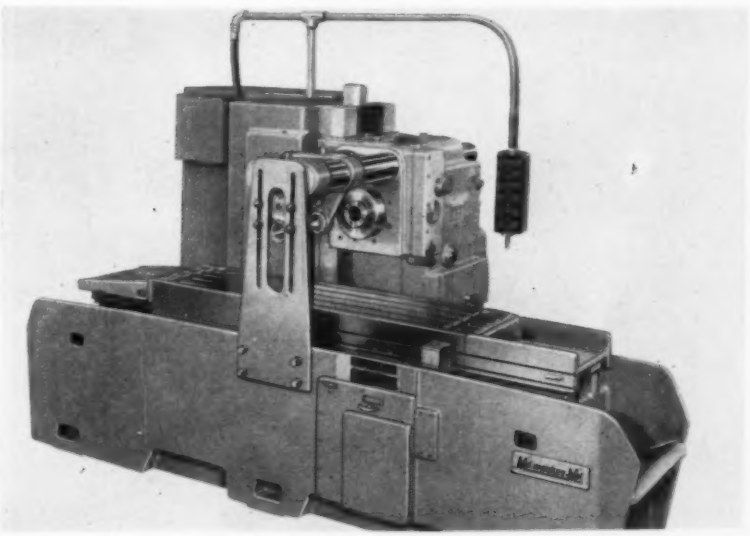
quires less than 2 x 4 ft of bench space, yet is capable of such operations as drilling, cutting, engraving, slicing, dicing and the production of complex shapes and forms in germanium, ceramics, silicon, ferrite, hardened steel and carbide.

The magnetostrictive transducer is powered by a 250-w electronic generator. Machine has 8-in. longitudinal and 6-in. transverse table travel, an 8-in.-dia workchuck, and a vertical tool adjustment of 2 in.

The complete unit, excluding toolholder and abrasive, sells for $3650.

Sheffield Corp, Dayton 1, Ohio

MORE DATA? Circle 57, inside back cover



Ingersoll-Rand Adds Two New Impactools to Air-Powered Line

Added models are the Size 5081T Torque Control Impactool for application where accurate torque control in the 50 to 150 ft-lb range is required, and the Size 5081 Impactool for nut-running jobs up to ⅝-in. bolt size. Design changes include air-balanced throttle valve for easily controlled throttle graduation and trigger pull; exhaust noises have been eliminated; complete one-hand control of the tool is afforded as reversing is accomplished by shifting a small lever within easy reach of the thumb; torsion bar torque control keeps the torque constant for all nut-running conditions, assuring proper torque on all nuts.

The 5081T runs at a free speed of 1350 rpm and will deliver 2000 impacts per minute at 90-psi air pressure. Adjustable torque range is from 50 to 150 ft-lb. When preset torque is reached, tool shuts off automatically. The 5081, without torque control, runs at a free speed of 2000 rpm and, when impacting, delivers 2000 impacts per minute at 90-psi air pressure. Tool has a rated capacity of ⅝-in. bolt size with plenty of reserve power.

Ingersoll-Rand Co, 11 Broadway, New York 4, NY

MORE DATA? Circle 58, inside back cover

Operator Dials Milling Machine Program Directly From the Blueprint

Bed-type Mil-waukee-Mil provides automatic production milling by dialing the results directly from the blueprint. Operator programs machine functions on the Dial-a-Cycle control panel by phase-switch dials that control each machine function automatically. Any number of functions can be phased into a cycle, including automatic quill retraction, rise and fall to the head, and tracer control.

Two-way milling cycles with automatic center stop for load and unload can be obtained by pressing a button to resume the cycle; stops can be made to occur at any place in the cycle. Change from automatic Dial-a-Cycle to manual operation is accomplished by flicking a switch.

Seventy-two models are available in both simplex and duplex styles with power ranging from 7½ to 30 hp.

Kearney & Trecker Corp, Milwaukee 14, Wis

MORE DATA? Circle 59, inside back cover

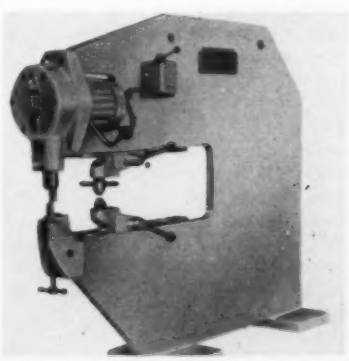
Gulton Industries Will Market French Ceramic Cutting Tools

Ceroc ceramic cutting tools, made by Compagnie Generale d'Electro-Ceramique in France, are reported to cut faster and last longer than comparable ceramic tungsten carbide tools, with an efficiency 4 to 16 times greater.

These insert tools are made by a unique process. Alumina, 99.9 plus percent pure, in particle sizes from 1 to 10 microns, is compressed and fired to give the maximum density in the end product. The tools are made without cement or binder materials, giving them greater resistance to brittleness and shearing.

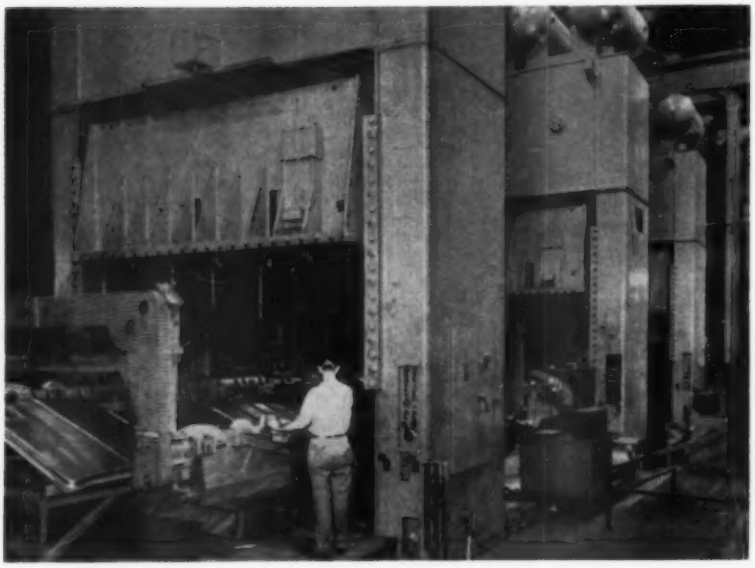
Marketed by Gulton Industries, Inc, 212 Durham Ave, Metuchen, NJ

MORE DATA? Circle 60, inside back cover



MODEL P-1 PULLMAX SHEARING AND FORMING MACHINE works sheet metal to 13 gage or lighter. Unit operates with stationary lower tool and reciprocating upper tool to do straight, circular, inside, irregular, slot and louver cutting as well as beading, joggling, flanging, edge-bending, and dishing—*American Pullmax Co, Sheffield and Altgeld Sts, Chicago 14, Ill*

MORE DATA? Circle 61, inside back cover



Niagara Modernizes Its Line of Large, Straight-Side, Eccentric-Geared Presses

Featuring enclosed, trim-line construction, the Series SE straight-side, eccentric-geared presses have been modernized to handle a greater variety of large, heavy-tonnage drawing, punching and blanking work. Produced with one-, two- and four-point suspension, in increased capacities now ranging from 100 through 1250 tons, the line includes 130 models. All can be readily modified and equipped for automation.

A key feature is the Niagara crankless eccentric gear drive which reportedly delivers greater torque with less deflection than is possible with other types of construction. The eccentric is an integral part of the main gear which rotates on a stationary pin rigidly supported in the crown; the pin serves merely as a pivot, carrying no torsional load and little bending load.

All electrical, air and circulating oil controls are enclosed in the uprights. Operating controls are conveniently mounted on a master panel.

Niagara Machine & Tool Works, 683 Northland Ave, Buffalo 11, NY

MORE DATA? Circle 62, inside back cover

GE Introduces Packaged Static DC Power Supplies for Motor Drives

Packaged static dc power supplies for motor drives are now available in ratings up to 300 kw. Applications are expected to be found in the metal rolling and processing industries, in feed drives for machine tools, conveyors, paper machine helper drives, printing press drives, and synchronous motor field supplies.

Units may be used in place of the motor-generator sets normally used in processing lines and similar applications where non-reversing adjustable speed drives, without pumpback are required. Advantages include high reliability, reduced downtime, and savings in floor space.

General Electric Co, Schenectady 5, NY

MORE DATA? Circle 63, inside back cover

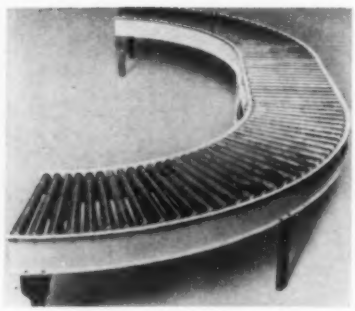
Portable Bench Tumbler Finishes Small Parts

Improved Mini-Tumbler has a 24-52-rpm variable speed drive for added flexibility. The 1-gal capacity unit is available with either open conical or closed hexagonal burring barrel, protected with No Seam vinyl plastic lining.

Power is furnished by a 1/12-hp 110-v motor. Model is 10 in. long by 12 in. wide x 10 in. high. Net weight is approx 25 lbs with an open barrel. Price is about $135.

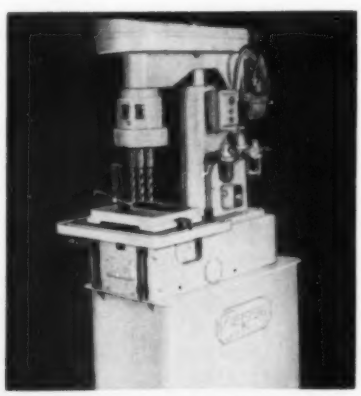
Rampe Mfg Co, 14915 Woodworth Ave, Cleveland 10, Ohio

MORE DATA? Circle 64, inside back cover



POWER-DRIVEN LIVE ROLLER CONVEYOR, actuated by special heavy-duty V-belt, is made with straight face or tapered rollers in various diameters and lengths of roller to suit application. Standard 4 ft 6 in. and 6 ft 0 in. radius are manufactured; 45° 90°, and 180° curves are available—*Sage Equipment Co, Buffalo, NY*

MORE DATA? Circle 65, inside back cover



Zagar Adds 22-in. Model To Line of Drilling Machines

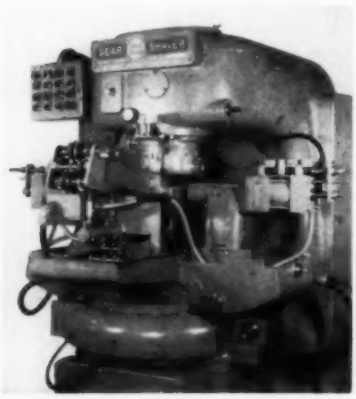
New 22-in. air-oil-feed drilling machine is designed to handle larger work and heavier sections on a wider variety of materials. It will accommodate more drills and larger drills than the 14-in. machine.

Thrust capacity is 2000 lbs with compressed air at 80 psi fed into the

head end of a 6-in.-dia cylinder. Unit is designed to mount a 215-frame motor. This can be 5 hp at 3500 rpm; 3 hp at 1750 rpm; 2 hp at 1160 rpm; or 1½ hp at 870 rpm. Controlled or slow feed of ram can be adjusted from zero to full 6 in. Adjustable stops can be set to use any total length of stroke desired. Only control needed is a switch to start and stop the motor; all others are mechanical controls built into the machine.

Zagar, Inc, 23886 Lakeland Blvd, Cleveland 23, Ohio

MORE DATA? Circle 66, inside back cover



Red Ring Automatic Loader Speeds Gear Shaving Setups

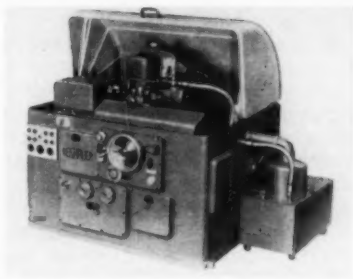
Improved design of unit for handling cluster gears on rotary gear shaving machines enables it to handle four different gears on a single cluster.

Loader is a rocker type in which an air cylinder powers a rocker arm mechanism that removes gears one at a time from an input magazine feed and deposits them in shaving location where air-powered head and tailstocks position them for the shaving operation. Finish-shaved gear is removed from shaving position and placed in an exit chute while the next gear is loaded into position. Input size gaging function in the loader is provided by passing the particular gear to be shaved between a pair of master gears before it enters the storage magazine.

To make a gaging setup for a particular gear, the upper master is moved axially into predetermined location and locked with cone-point screw. Lower master is moved into proper poppet position.

National Broach & Machine Co, 5600 St Jean, Detroit 13, Mich

MORE DATA? Circle 67, inside back cover



Automatic Thread Grinder Handles Small Workpieces

The Reishauer RAG automatic thread grinder (Swiss-made) is designed for precision thread grinding on small parts such as taps with straight and helical flutes (with or without relief), micrometer spindles, thread gages, and small, fine-pitch worms. Single-rib grinding wheels with longitudinal feed do the grinding.

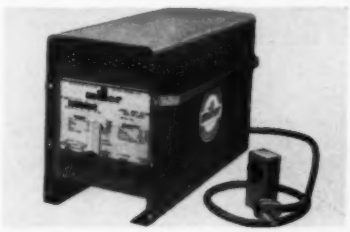
Once the machine is set up, the operator's only task is to change the workpiece. Re-profiling of the grinding wheel takes place during the return stroke of the table slide, and can be set to occur after 1, 2, 3, 4 or 6 strokes. Three re-profiling speeds are available.

Machine features automatic feed compensation for decreased wheel diameter. An automatic, electric truing device has two dressing heads that operate independently but simultaneously. Specifications include: maximum grinding length, 9¾ in.; distance between centers, 20 in.; max workpiece dia, ¾ in.; min workpiece dia, 0.04 in.; pitch range, 6 to 80 threads per in.

Optional equipment: a coolant temperature control system and an electric truing device with one dressing head in which one diamond tool oscillates along both flanks and describes a radius if desired.

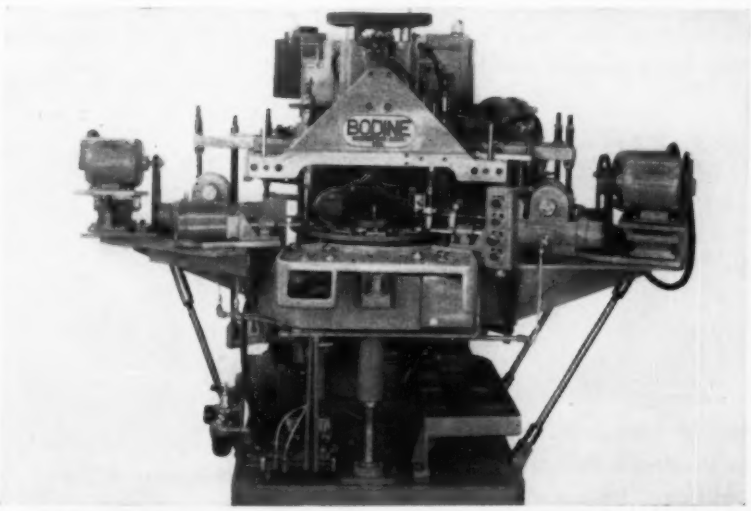
Imported by Cosa Corp, 405 Lexington Ave, New York 12, NY

MORE DATA? Circle 68, inside back cover



COMBINATION AC-DC TRANSFORMER-RECTIFIER WELDER, Model 180 Twin, delivers two ac ranges, 20-115 and 60-180 and one dc range of 40-150 amps—*Miller Electric Mfg Co, Appleton, Wis*

MORE DATA? Circle 69, inside back cover



STEEL CLUTCH DRUMS are machined at the rate of 300 pieces per 50-minute hour. Twelve operations are performed on this machine which has three horizontal drill spindles; one horizontal tap spindle; one vertical milling spindle; and two inverted drill spindles, one with a two-spindle head. Two automatic inspections are included in the cycle—*Bodine Corp, Bridgeport, Conn*

MORE DATA? Circle 70, inside back cover

Air-Operated Butt Welder Makes Up to 2500 Welds per Hour

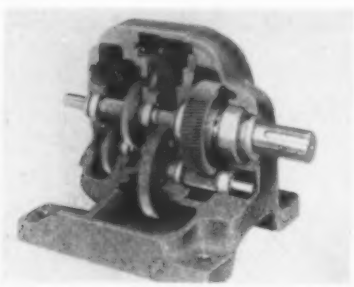
Model BW air-operated butt welder, making up to 2500 welds per hr, is designed for welding wire rings, rectangulars, flats and angles in both cold-rolled and hot-rolled materials.

Each jaw has an independent cylinder. Step-in die permits fast alignment for welding wires ranging from 1/16 to 1/2 in. dia with the same jaw setting. A turn of an adjusting screw initiates and controls current flow after the jaws grip the workpiece.

Machine is equipped with air regulator, gage, automatic oiler, filter cleaning unit, foot control, three air cylinders, automatic air pressure switch, and a heavy-duty magnetic contacter.

Alphil Spot Welder Mfg Corp, 1058 Pacific St, Brooklyn 38, NY

MORE DATA? Circle 71, inside back cover



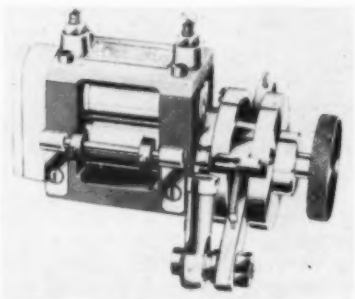
Helical Gear Drive Offered In Quadruple Reduction Model

Quadruple reduction helical gear drive, and new, larger sizes of double and triple reduction drives have been added to Link-Belt's In-Line line. Drives with capacities to more than 200 hp are available. Compact quadruple reduction speed reducer, furnished in five sizes, extends range of ratios as high as 2217:1.

Simple gear arrangement consists of helical gear trains operating in high-capacity ball and roller bearings mounted in a cast iron housing. Space requirements and layout problems are minimized by locating input and output shafts in the same horizontal and vertical planes. Automatic splash lubrication of all moving parts assures dependable lubrication and operation at all speeds.

Link-Belt Co, Dept PR, Prudential Plaza, Chicago 1, Ill

MORE DATA? Circle 72, inside back cover



Jaco Expands Line of Automatic Roll Feeds for Punchpresses

Twenty-six new sizes have been added to company's line of lowcost, automatic roll feeds for punchpresses. With a total of 39 standard sizes, the line has a range of feed increments from 1 in. to 20 in. in length and up to 20 in. in width. Feeds are designed for side or rear feeding and will fit any light or heavy-duty punchpress.

Jaco Devices, Inc, Hingham, Mass

MORE DATA? Circle 73, inside back cover

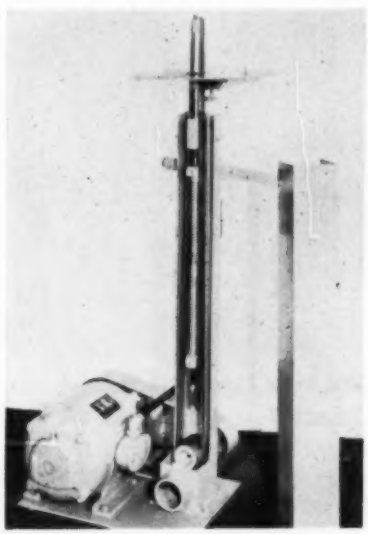
Automatic Hydrocopy Miller Machines Turbine Blades

The Rigid ST-100 (Swiss-made) automatic hydrocopy blade milling machine handles jet engine, gas and steam turbine blades up to 16 in. in length of blade section. Available as a 2- or 3-spindle machine, it has completely hydraulic control. Working accuracy is reported to be ±0.002 in. with excellent finish.

Fully automatic cycle includes automatic switchover from pendulum milling along the shroud to fast sweep milling along the length of the blade. Sweep milling speeds up to 40 ipm are possible. Feed rate remains constant over any profile up to angles of 80°. An additional transverse copying device permits 3-D machining of blades with angular shrouds. The 16 spindle speeds range from 24 to 420 rpm.

Imported by Cosa Corp, 405 Lexington Ave, New York, NY

MORE DATA? Circle 74, inside back cover



Abrasive Belt Grinder Finishes Tight Inside Surfaces

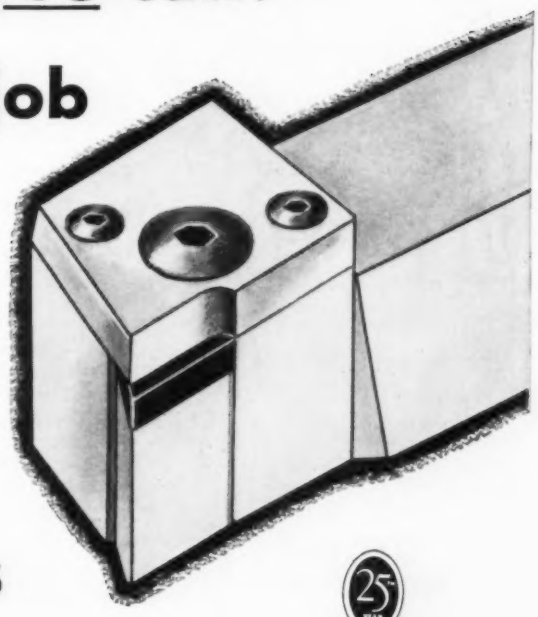
This low-priced abrasive belt unit, Model TS-90, is designed so that it can be used to finish inside surfaces where clearance is a major factor. Shown here with its protective cover removed, the tool uses a 1- or 2-in.-wide 90-in.-long belt, and is suitable for use on metal, wood or plastics for the removal of flash or parting lines on nonferrous castings, molded rubber and plastic parts, or sharpening special die shapes.

Platen and slack-of-belt grinding can be done on the standard model. Tool can be purchased with or without motor. Accessories available include a rubber-covered contact wheel and an adjustable tilting table.

Grinding & Polishing Machinery Corp, 2530 Winthrop Ave, Indianapolis 5, Ind

MORE DATA? Circle 75, inside back cover

Nobody can cut steel better than you can! Any cutting job is easier when you rely on V-R carbides



COMPLETE LINE OF CARBIDE, CERAMIC AND TANTUNG® CAST ALLOY CUTTING TOOLS.

Engineered by production men to solve production problems

It's the carbide that cuts . . . and solving cutting problems becomes a simple matter of engineering the V-R carbide for the job. V-R Production Engineers have worked with thousands of cutting problems and developed carbides for maximum cutting efficiency in practically any application.

Put this fund of cutting know-how to work solving your problems. Just give us the details on the operations performed, material specs, speeds and feeds desired, dimensional tolerances, desired surface finish and all other pertinent data — it's dollars to doughnuts we've already engineered the V-R carbide for the job. V-R Engineers will work with you to fit the right carbide to the job and reduce cutting costs.

Send for new Catalog VR-58 for complete details

V-R Vascoloy-Ramet corporation

PRIME MANUFACTURERS OF REFRACTORY METALS ENGINEERED FOR THE JOB

C-703

810 Market Street • Waukegan, Illinois

MARKING METAL?

Blaisdell Markers write on anything.

CHINA MARKER

Bold, bright marking for all slick surfaces — 14 vivid colors.

GET THESE BLAISDELL EXCLUSIVES

SPEE-D-POINT perforation for easy sharpening—STED-D-POINT staple for secure lead

DU-ALL MECHANICAL PENCIL

Marks all surfaces. Six colors with matching leads.

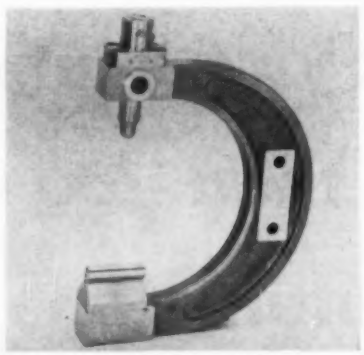
Write for sample naming this publication. Our many special pencils have solved varied marking problems since 1893. Let us help you.

TRADE MARKS REG. U.S. PAT. OFF.

BLAISDELL PENCIL COMPANY

BETHAYRES, PENNA.

NEW SHOP EQUIPMENT



Gage Checks Pitch Diameter Of Gears, Splines, and Worms

Device incorporates a mechanical amplifier mounted on the gage body to amplify measurements five times. A step on top of the amplifier unit shows instantly whether or not minimum tolerances are exceeded. Steps are ground with a tolerance of + 0.0000 and − 0.0005.

Gages are obtainable for practically all sizes of gears.

Holmes Gage & Development Corp, 537 Bonham Ave, Columbus 3, Ohio

MORE DATA? Circle 76, inside back cover

Air service package includes all items needed to put together air service assemblies for any airline need. Includes blow gun with variety of nozzle attachments; quick-disconnect ends with check units and adapters with nipple attachments for any size and type; Barb-Tite hose ends available in size range from ¼ through ¾ in. in eight styles; hose with pressure recommendations to 250 psi.

Weatherhead Co, Fort Wayne Div, 128 W Washington Blvd, Fort Wayne, Ind

MORE DATA? Circle 77, inside back cover

Reversible ratchets with small, compact heads and simple shift lever are easy to use in tight places. Tools are available in drive end sizes of ¼, ⅜, ½ and ¾ in.

Owatonna Tool Co, 383 Cedar St, Owatonna, Minn

MORE DATA? Circle 78, inside back cover

Marking material called Penapaint can be placed on bare metal to identify stock; it instantly penetrates subsequent paint coating. Applied with brush, spray, or stencil either before or during fabrication, it remains through all following fabri-

Fast Delivery

Quality

SIMONDS INDUSTRIAL CUT GEARS

★ FINISHED GEARS

★ CUSTOM GEAR CUTTING

★ HEAT-TREATED, CASE OR FLAME-HARDENED

You are sure of quality and prompt service when you place your industrial cut gear requirements with SIMONDS GEAR. We produce the full range of sizes in the types and materials you need from your blanks or ours. Let us quote on your next gear requirements.

* * *

Stock carrying distributors of Ramsey Silent Chain Drives and Couplings; and industrial V-belts.

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WORMS • WORM GEARS
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Cast or forged steel, gray iron, bronze, Meehanite, rawhide or bakelite

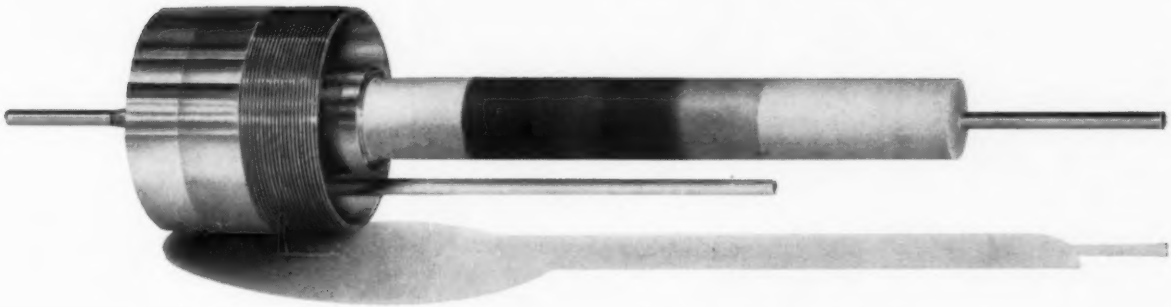
SIMONDS GEARS

THE SIMONDS GEAR & MFG. CO.

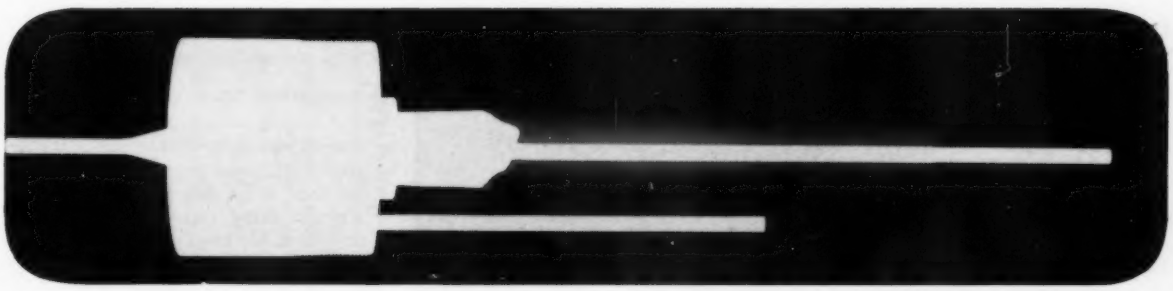
LIBERTY at 25TH PITTSBURGH 22, PA.

Quality Gears for over 65 years

Seal unit of one of the repeaters of a transoceanic telephone cable.



It has a 20-year job 3 miles under the sea



Radiography reveals no foreign particles or voids in molded areas, shows the ultimate contact of the molded insulation with the central conductor.

Radiography shows the rubber seal and molded parts are ready to take it

EVERY 40 MILES along a transoceanic telephone cable, there is a repeater—an electronic masterpiece designed to boost the message along and made to operate 24 hours a day for a minimum of 20 years.

Any foreign particles in the molded parts of the seal could reduce its performance. And with sea water pressures up to 8000 lbs. p.s.i. to resist, the adherence of the rubber seal areas to the central conductor and outer metal shell must approach perfection.

Radiography assists Western Electric to make sure that each repeater measures up to specification.

Using Kodak Industrial X-ray Film, Type AA, the radiographer can inspect each repeater thoroughly, and quickly. This film has the sensitivity and speed to enable the work to be done even with low-power x-ray equipment.

In all applications, Type AA Film is producing quality work in far less time. It is extending the service of present x-ray equipment, and increasing production with gamma-ray sources.

Have your x-ray dealer or Kodak Technical Representative tell you about it. It saves time and money.

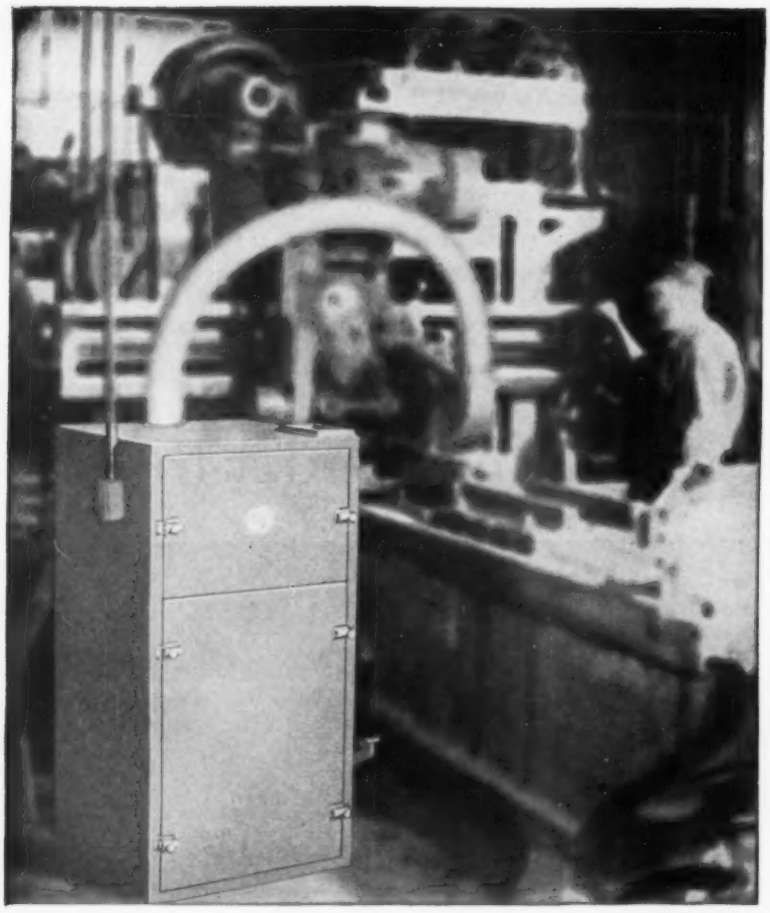
EASTMAN KODAK COMPANY, *X-ray Division*, Rochester 4, N. Y.

Kodak Industrial X-ray Film, Type AA

Read what Kodak Industrial X-ray Film, Type AA, does for you:

- Speeds up radiographic examinations.
- Gives high subject contrast, increased detail and easy readability at all energy ranges.
- Provides excellent uniformity.
- Reduces the possibility of pressure desensitization under shop conditions.

Kodak
TRADE MARK



How *unitized* Torit Dust Collectors cut your costs . . . protect machines and worker morale

Here's the most flexible and economical method of trapping dust that damages your equipment and creates employee health and morale problems. Torit units trap dust at its source. They're completely self-contained and portable. This means you can install Torit Collectors yourself, shift them as requirements change, operate them only as needed. They can be suspended or installed next to the machines they service. You can wire them directly through equipment switches to conserve power and let them return filtered air to the room to save heat. There's a complete range of types and sizes.

6 machines serviced by Torit for $666.15 complete. This Torit Model 219FM was installed at the Mohr Lino Saw Co., Skokie, Ill. to collect dust from 3 belt sanders and 3 different types of grinders (2 grinders hidden from view). The Collector *plus* all accessories were supplied by Torit at a total cost of $666.15—another example of the economy and efficiency Torit offers you.
For more FREE facts on dust problems and dust control, write:

TORIT MANUFACTURING COMPANY
311 Walnut Street, St. Paul 2, Minn., Dept. 405

cating and assembly operations. It can be removed when no longer required by application of Penapaint Mask which dries quickly and reportedly provides an excellent base for any type of finish paint coating.
Phillips Products, Inc, 1435 E 17th St, Cleveland 14, Ohio

MORE DATA? Circle 79, inside back cover

Sealing resin called Impal, for sealing small cavities, cracks, and pores in anodized aluminum or aluminum alloys, is a liquid product with surface tension much lower than the capillary resistance of the smallest pores. After curing, it forms a seal which resists acids, alkalis, and saline atmosphere. Impal-sealed surfaces may be coated with any standard coating material or paint.
Columbia Technical Corp, 61-02 Thirty-First Ave, Woodside 77, NY

MORE DATA? Circle 80, inside back cover

Speed reducing device for Delta 20-in. drillpresses permits machines to perform slow speed operations such as spotfacing, reaming, counterboring, core drilling, and cutting wooden plugs. Using the 5-pulley drillpress drive, the speed range is 70 to 1700 rpm with a 1140-rpm motor and 105 to 2600 rpm with a 1725-rpm motor. Known as the Slo-Speed attachment, the device fits machines with No. 2 or No. 3 Morse Taper spindles. Price is $68.75.
Rockwell Mfg Co, Delta Power Tool Div, 496 N Lexington Ave, Pittsburgh 8, Penna

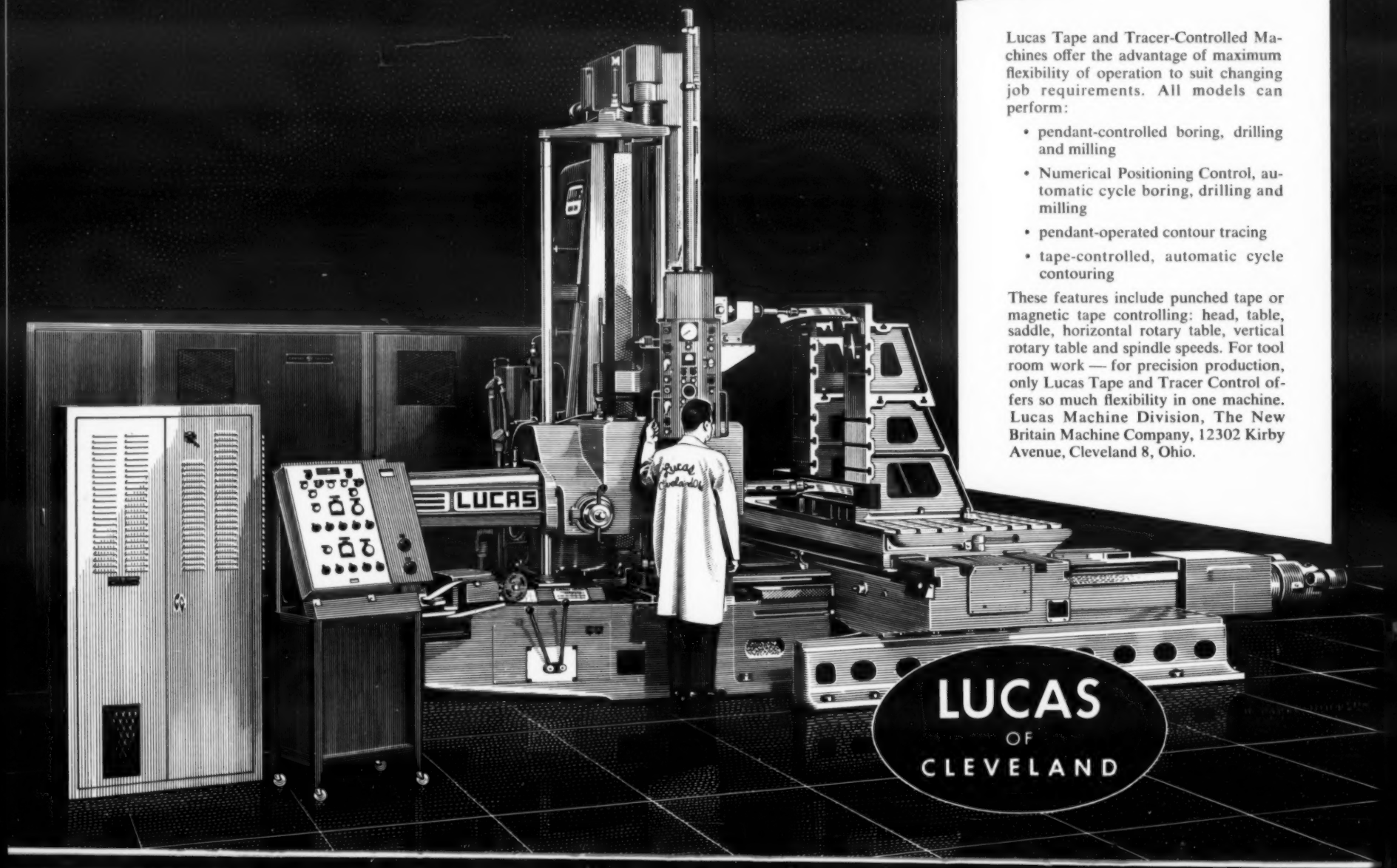
MORE DATA? Circle 81, inside back cover

Electrode called Stoody Build-Up (iron powder coating) for manual application is said to have high tensile strength, resistance to cold flowing under compressive load, high

"We have the know-how to do your job, Mr Swartz. But we don't have the what-with."

A New Lucas Lathe
Fully-automatic Tape Control, Tracer Control or both. Infinitely variable speeds and feeds. Automatically-maintained, constant-cutting speeds on changing diameters. Console control from moving operator's platform. *Three* hardened and ground ways. Self-contained Motor Generator Set.
The Lucas Lathe — perfect for your large, lightweight, close tolerance, intricately-shaped problem jobs. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.
LUCAS
OF
CLEVELAND

Lucas Tape and Tracer Control



Lucas Tape and Tracer-Controlled Machines offer the advantage of maximum flexibility of operation to suit changing job requirements. All models can perform:

- pendant-controlled boring, drilling and milling
- Numerical Positioning Control, automatic cycle boring, drilling and milling
- pendant-operated contour tracing
- tape-controlled, automatic cycle contouring

These features include punched tape or magnetic tape controlling: head, table, saddle, horizontal rotary table, vertical rotary table and spindle speeds. For tool room work — for precision production, only Lucas Tape and Tracer Control offers so much flexibility in one machine. Lucas Machine Division, The New Britain Machine Company, 12302 Kirby Avenue, Cleveland 8, Ohio.

impact strength, low tendency to work hardening, and limited increase in hardness under severe quench. At 250 amps rod has a deposition rate of better than 6 lbs per hr. Operating either ac or dc (either polarity), weldability is reportedly excellent, spatter loss low. It may be applied in either stringer beads or wash passes. Product is packaged in 50-lb containers.

Stoody Co, Whittier, Calif

MORE DATA? Circle 82, inside back cover

Centrifuge Removes Solids from Cutting and Grinding Coolants

This easily installed centrifuge is designed for grinding, honing, lapping, polishing and cutting machines. It is reported to be ideal for coolant clarifying, liquid processing and particle separation.

Centrifuge is available in two models. No. 510 has a capacity of 150 gal per hr and is priced at $275; No. 515, 1000 gal per hr, sells for $375. They may be used in multiple setups for larger volume operations. Only things needed for installation are pipe fittings or rubber hose.

A M Lavin Machine Works, Hatboro, Penna

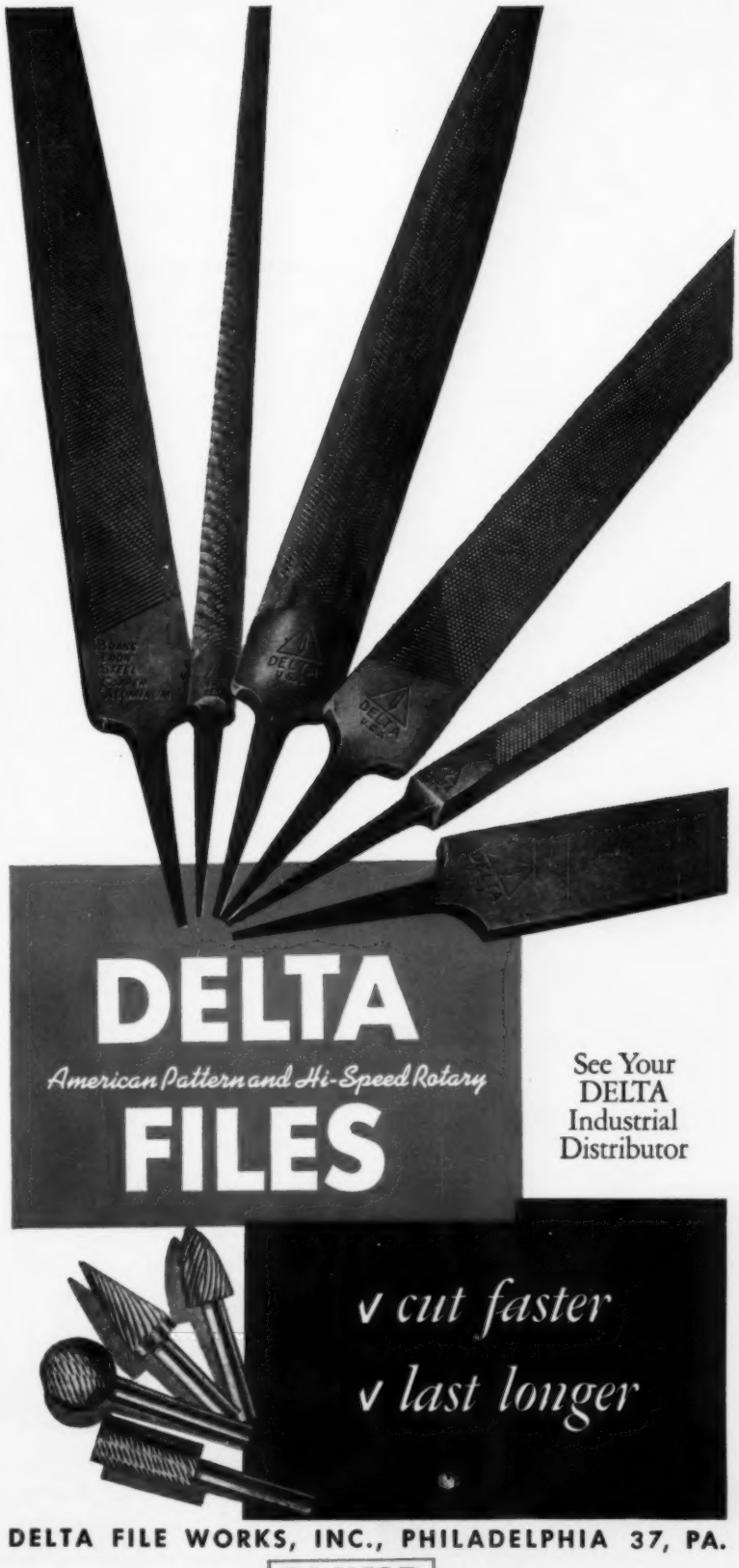
MORE DATA? Circle 83, inside back cover

Improved file chuck for Keller Die Filers has a floating jaw that is tightened by a single screw, accommodating itself to any shape file shank. A recess in the chuck post provides extra support for the shank.

Sales Service Machine Tool Co, 2363 University Ave, St Paul 14, Minn

MORE DATA? Circle 84, inside back cover

Bacterial inhibitor called Elcide 75 reportedly will extend the life of soluble oil emulsions at least two to four times. It is effective in all standard duty emulsions and preliminary



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Lick it with this NEW INDUSTRIAL DETERGENT

A MAJOR BREAKTHROUGH IN PRECISION CLEANING

I/D

I/D: H-50 Designed for Cleaning by Hand

I/D: M-100 Engineered for Machine Cleaning

CLEANS BETTER! • CLEANS FASTER! MORE ECONOMICAL!

Safe — non-poisonous — odorless — non-irritating to skin — works equally well in hard or soft water — removes dirt and particles even from inaccessible or irregular surfaces — eliminates time-consuming scrubbing — will not etch fine surfaces —completely soluble, rinsable, leaves no residue or film.

Send for FREE 3 lb. Sample and Price List on your Company Letterhead.

INDUSTRIAL DETERGENTS
Division of Alconox, Inc.
853 Broadway, New York 3, N. Y.

NEW SHOP EQUIPMENT

studies indicate that it is also effective in protecting synthetic coolants. Recommended use is one ounce in four gallons of fresh emulsion. (*AM*—Aug 25 '58, p59)

Eli Lilly & Co, 740 S Alabama St, Indianapolis 6, Ind.

MORE DATA? Circle 85, inside back cover

Adjustable spacing collars for milling machine cutter arbors (*AM*—Aug 26 '57, p153) are made of hardened and ground alloy steel, and are now available for cutter arbors from ⅞ to 2 in. Adjustment on the smaller collars is 3/32 in.; on the larger, 3/16 in. Prices range from $15.30 to $25.35.

Dayton Rogers Mfg Co, 2824 13th Ave S, Minneapolis 7, Minn.

MORE DATA? Circle 86, inside back cover

Small gage blocks, measuring only ¾ in. long by ⅛ in. wide, are made to inspection quality and can be wrung together to form any combination between 0.1000 and 1.50000 in. in increments of 0.0001 in. Designed for precision measurement of miniature components, these blocks can measure small bores, chordal dimensions across serrations, the distance between cylinders located in serrations and splines, or the space width of straight splines.

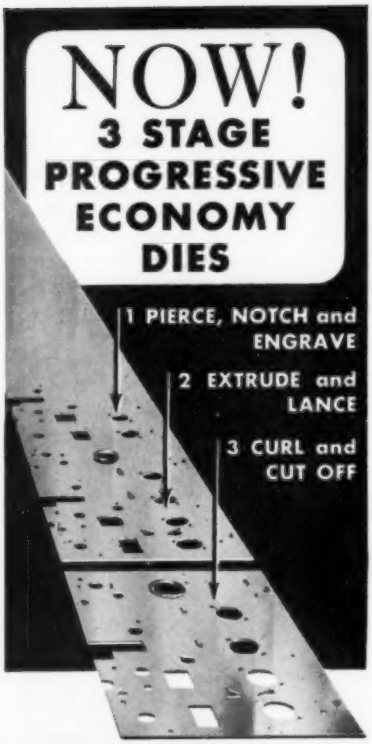
Distributed by Engis Equipment Co, 431 S Dearborn St, Chicago 5, Ill.

MORE DATA? Circle 87, inside back cover

Anti-sticking agent called Slide is an aerosol spray incorporating high silicone content. Low surface tension permits it to spread out for thorough

"It bogs down between this control and that—can't you put some exciting looking meter there?"

NOW! 3 STAGE PROGRESSIVE ECONOMY DIES



Savings YOU CAN SEE

die material cost	$63
tooling time	45 hours!
set-up time	10 minutes!

over 5000 pieces per day!
(hand feed, 8x6", 20 ga. CRS)

Now you can benefit from economy tooling for compound, progressive and other types of tool designs.

Parts are produced in any gauge or material by means of Templet tooling processes — at substantial savings.

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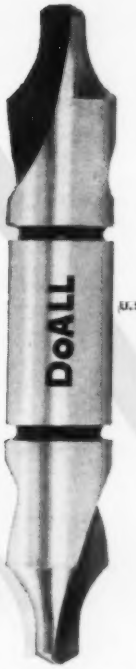
The Templet Process (Pat. Nos. 2,495,221 and 2,850,096) is also available for use in your own shop. Now licensed to more than 150 major U.S. manufacturers. Write for details.

THIS NEW CURVE CUTS COSTS



U.S. PAT. NO. 2403861

EXCLUSIVE IN DoALL SAFETY CENTER DRILLS

Here's why costs take a tumble with these new DoALL Center Drills:

Radial Type—This new precision-ground *curve* now eliminates the old fatigue point found in standard drills—the familiar sharp notch where the 60° angle meets the drill portion. This new radius angle provides greater strength and gives tip clearance to the drill portion. This provides the ultimate in minimizing breakage. Corners are automatically deburred. It also reduces friction between lathe center and work... provides a larger oil reservoir. Center grinding is eliminated on hardened parts. Lapping is fast and easy.

Heavy-Duty Type—Cuts an entirely new type of burr-free center. An 82° ground top angle forms a cutback edge. There is a slight radius where the 60° angle meets the drill portion—no sharp notches! Provides a larger bearing surface for heavier parts as compared to the radial type.

Think of it! These longer-lasting, faster-cutting DoALL Safety Center Drills cost no more than the old plain type—and actually cost 10% to 15% *less* than ordinary bell types.

That's why more and more alert men have changed to DoALL. Try it—and see the difference!

Only DoALL offers ALL these features:

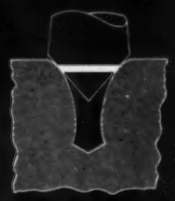
- Less drill breakage
- No fatigue point
- Greater drill strength
- Higher cutting efficiency
- Resharpenable
- Perfect work centering

—PLUS still more cost-cutting opportunities:

Deburring eliminated

Center grinding eliminated

Lathe-center damage eliminated

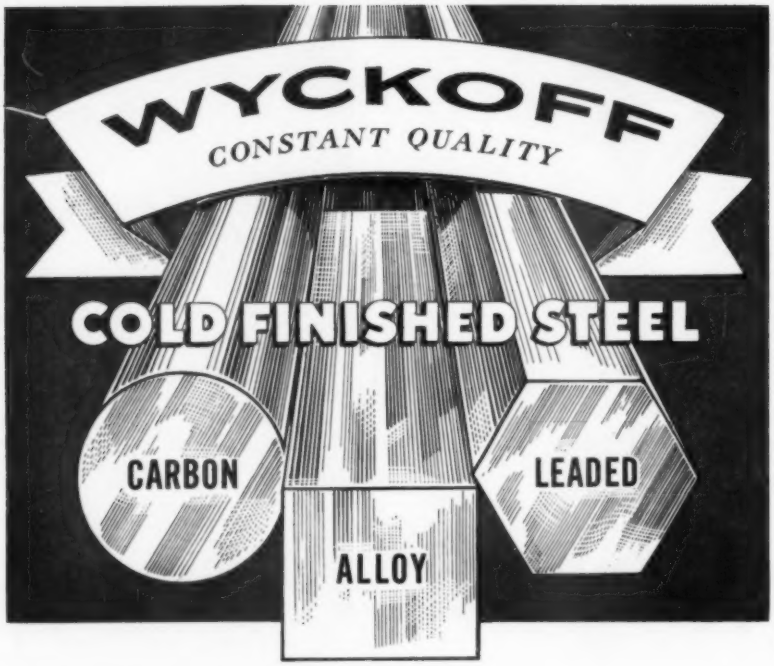


Radial Type Drilled Hole

Heavy-Duty Type Drilled Hole

If it's a DoALL it's top quality... it's rigidly laboratory-inspected ...and it saves you money through low-cost, nation-wide distribution.
—*Danny DoALL*

CT-38



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PRODUCTION *"MUSTS"*

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2 ULTIMATE MACHINABILITY
3 SUPERIOR FINISH
4 LONGER TOOL LIFE

SPECIALISTS IN COLD FINISHED STEELS EXCLUSIVELY

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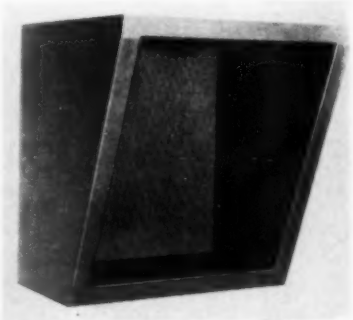
OUR CONSTANT RESEARCH PROGRAM IS YOUR BEST GUARANTEE OF QUALITY CONTROL

WYCKOFF STEEL PRODUCTS: Carbon, Alloy and Leaded Steels • Turned and Polished Shafting • Turned and Ground Shafting • Large Squares • Wide Flats up to 12¾" x 2¼" and 14" x 1¼" All types of Furnace Treated Steels.

lubrication of intricate mechanisms. Product is odorless, colorless, non-staining, and non-toxic.

Perc E Harms Co, 1815 Harding Rd, Northfield, Ill

MORE DATA? Circle 88, inside back cover

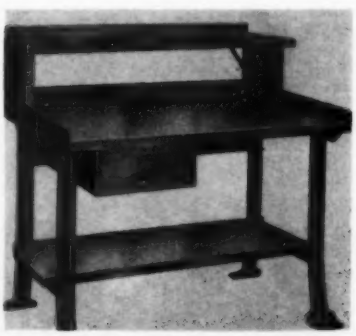


Telephone Booth is Designed For Noisy Plant Locations

Wall-mounted open telephone booth, designed for noisy plant locations, is made from heavy-gage steel with a perforated steel interior covering sound absorbing material built into the walls and top. It comes in gray hammerloid enamel finish and will withstand rough handling and corrosive atmospheres. Booth is 28 in. wide by 30 in. high and is 23 in. deep at the top, tapering to 15 in. at the writing shelf.

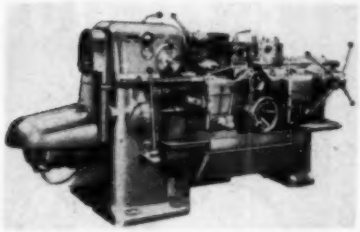
Suttle Equipment Co, 135 S La Salle St, Chicago 3, Ill

MORE DATA? Circle 89, inside back cover



48-IN. WORK BENCH is 34 in. high, is made in 28 and 34-in. depths, and is available with plain steel, tempered pressed wood over steel, or laminated hardwood top. Standard accessories include shelf, riser, electrical outlet strip, back and end stops, channel stringer and bench drawers — *Lyon Metal Products, Inc, Aurora, Ill*

MORE DATA? Circle 90, inside back cover



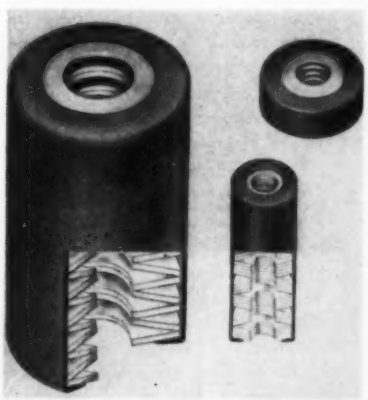
UNIVERSAL TURRET LATHE, R5, made in Czechoslovakia, has 20-in. swing over bed, 10-hp drive, and 2-in. bar capacity. The pre-selective headstock provides 18 speeds between 35 and 1800 rpm. Chucks, collet pads and turret tooling are interchangeable with American-made machines — *Imported by Sigma Machinery Inc, Two Park Ave, New York 16, NY*

MORE DATA? Circle 91, inside back cover

Lift truck clamp attachment permits both palletized and non-palletized loads, as well as those on skids and in bins, to be handled by any of the company's electric fork lift trucks. Attachment, which replaces the forks, is known as the Master Universal Clamp, and has a clamping range of 18 to 46 in. or 23 to 60 in., depending on the materials being clamped.

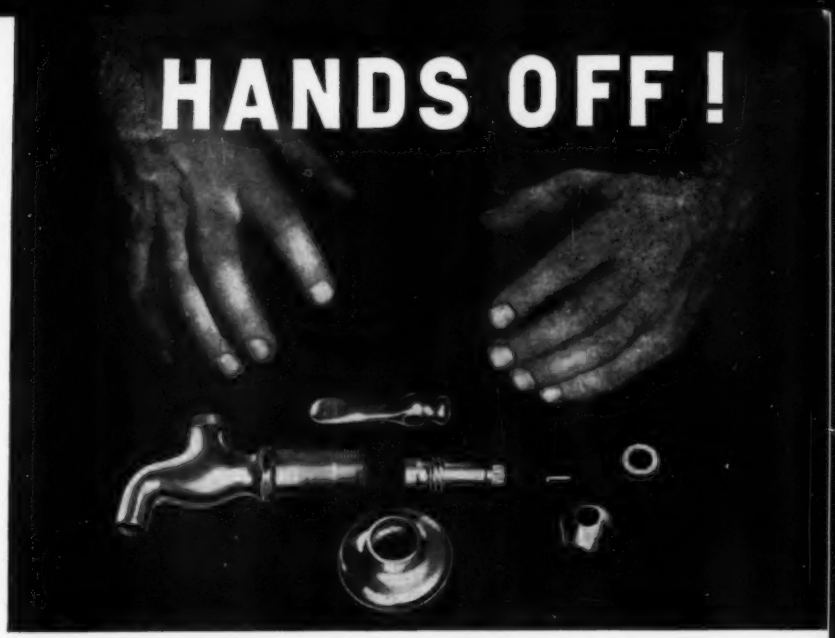
Lewis-Shepard Products, Inc, 125 Walnut St, Watertown 72, Mass

MORE DATA? Circle 92, inside back cover



Pre-Assembled Energy Cartridges Packaged in Elastic Covering

Flexi-Pak Energy Cartridges are compact spring units that can be incorporated as a one-piece component. They are pre-assembled stacks of Belleville spring washers held together by a flexible elastic covering, and designed for applications where pins or rivets cannot be used to hold



ASSEMBLED IN SECONDS with a
BENERSON AUTOMATOR

No worry about clumsy hands—production slow-downs or unstable quality. Precision assembly by a Benerson AUTOMATOR is automatic! The AUTOMATOR is a pre-engineered indexing unit which provides the motivation to the automation assembly operation. Benerson Automation specialists then adapt this base unit to your specific requirements—specially engineered for the feeding, orienting, placing and ejecting assemblies.

If you assemble volume parts—today's competitive market demands a Benerson AUTOMATOR to reduce assembly costs in your plant!

FURTHER INFORMATION AND DETAILS ON REQUEST. WRITE:

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STATION A, BOX 127, EVANSVILLE, INDIANA

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He frequently recommends Anderson wire brushes for those jobs requiring production efficiency with top quality results.

For lowest cost per unit processed select: Anderson.

Write for complete catalog of wire brushes with detailed selection and operation data.

Anderson

ANDERSON CORPORATION
1056 Southbridge Street
Worcester 10, Mass.

the washers together because washer walls are too narrow, or where retaining rings or cores cannot be used because there is not sufficient vertical or radial clearance.

Two types of covering are available: molded, which is cured around the washers while they are under a slight load, and a dipped or sprayed coating that is applied to the stacks while they are held firmly together but not relaxed. Both types serve to reduce the total weight of the assembly, reduce friction, and eliminate noise.

Advantages include: lower assembly costs because it is easier and faster to install than loose washers; washers will always be installed in the correct sequence; assembling can be done in jigs or by automatic machinery, more economical than assembling separate washers directly.

Associated Spring Corp, Bristol, Conn

MORE DATA? Circle 93, inside back cover

Kit Contains Accessories For Sharpening Carbide Tools

Kit contains a 6-in. magnetic chuck ready for mounting; single layer diamond grinding wheel ring; diamond ring lap attachment; 5-gram tube of Spectrum D57 Premier Gold Label Diamond Lapping Compound; roller; 4-oz bottle of Spectrum Diamond Lapping Oil; 4-oz bottle of Spectrum Thinner; Atomizer Oil Applicator; and Pensco Diamond Wheel Dressing Stick.

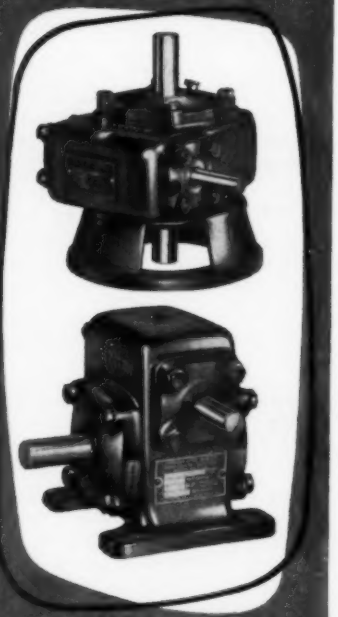
Penn Scientific Products Co, Abington, Penna

MORE DATA? Circle 94, inside back cover

Mechanical comparator, featuring the Super Compar-It gaging head, reads directly to 20 millionths of an inch and has a dial range of ±0.001 in. This German-made instrument has a cable-release arrangement for lowering and raising the contact point. Price, complete with stand

(Continued on page 146)

PERFECTION worm gear SPEED REDUCERS



available in ratios of 5 to 1 to 60 to 1

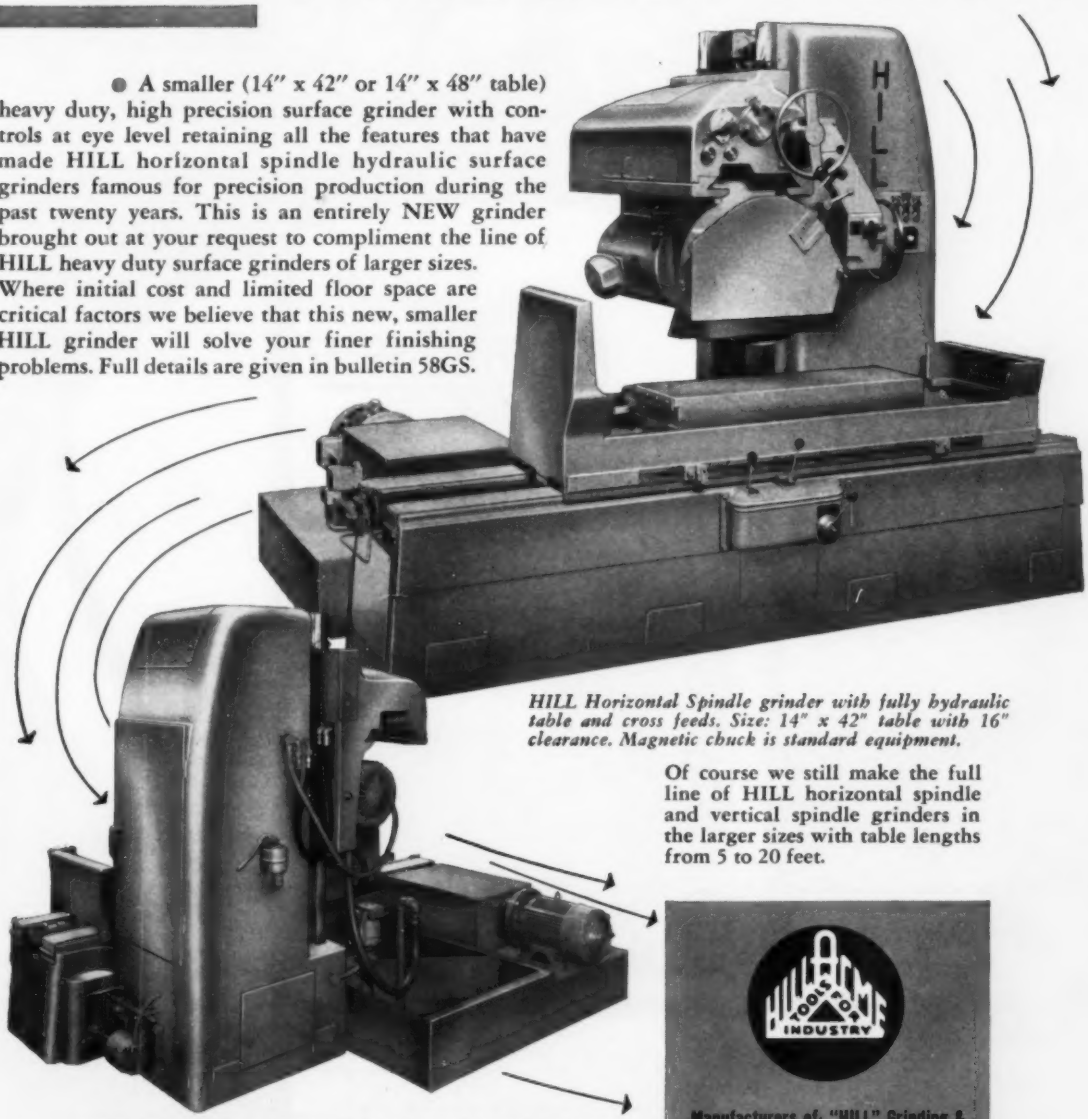
Perfection Worm Gear Speed Reducers by American Stock Gear are available in 9 complete series with ratios ranging from 5 to 1 to 60 to 1 for input revolutions ranging from 300 per minute to 1800 per minute. Speed Reducers are furnished in horizontal right angle drive with worm in either top or bottom position and are also furnished in vertical right angle drive. Integral worm and shaft is made of selected quality, case hardened alloy steel. Threads are precision ground and accurately mated with worm gear. Shafts are mounted in Timken anti-friction roller bearings. Oil seals are of selected cirvis leather which assures maximum sealing effect. Available through your nearest American Stock Gear Distributor.

Write for new 16 page catalog covering the complete PERFECTION Speed Reducer line.

AMERICAN STOCK GEAR DIVISION
PERFECTION GEAR COMPANY
HARVEY, ILLINOIS, U.S.A.

HERE IS THE GRINDER YOU ASKED FOR!

● A smaller (14" x 42" or 14" x 48" table) heavy duty, high precision surface grinder with controls at eye level retaining all the features that have made HILL horizontal spindle hydraulic surface grinders famous for precision production during the past twenty years. This is an entirely NEW grinder brought out at your request to compliment the line of HILL heavy duty surface grinders of larger sizes. Where initial cost and limited floor space are critical factors we believe that this new, smaller HILL grinder will solve your finer finishing problems. Full details are given in bulletin 58GS.



HILL Horizontal Spindle grinder with fully hydraulic table and cross feeds. Size: 14" x 42" table with 16" clearance. Magnetic chuck is standard equipment.

Of course we still make the full line of HILL horizontal spindle and vertical spindle grinders in the larger sizes with table lengths from 5 to 20 feet.

THE HILL ACME COMPANY

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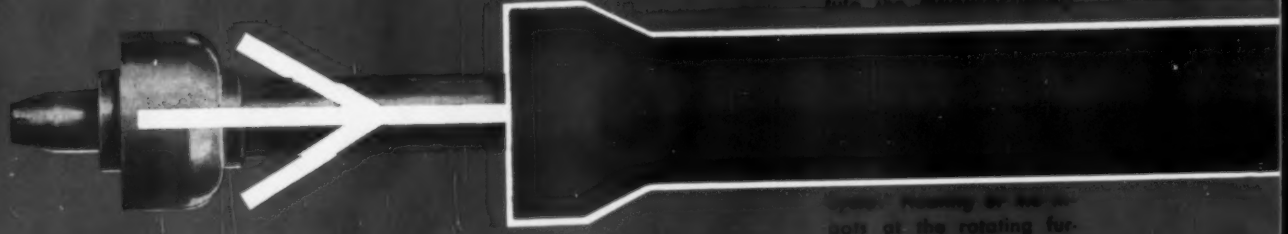
CLEVELAND 2, OHIO

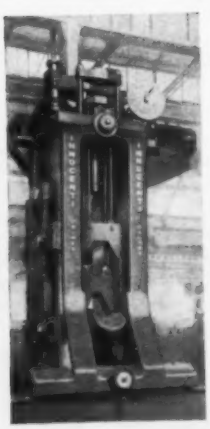
Manufacturers of: "HILL" Grinding & Polishing Machines — Hydraulic Surface Grinders — "ACME" Forging — Threading — Tapping Machines — "CANTON" Alligator Shears — Billet Shears — "CLEVELAND" Knives — Shear Blades

The "INNOCENTI-Calmes" pilger mill is suitable to manufacture seamless pipes up to an 18" diameter. The following steps constitute the manufacturing cycle: Heating of the ingots at the rotating furnace, piercing at piercing press (1) and preliminary rolling at the elongat equalizer mill (2) in or. to center the hole of the ingot and to improve the metallurgical qualities of the steel. The final rolling at the pilger mill (3) (4) (5) is obtained by forging and



Pilger mill and expanding installation for

INNOCENTI



works in milan (it

CIRCLE 399 READER SERVICE CARD

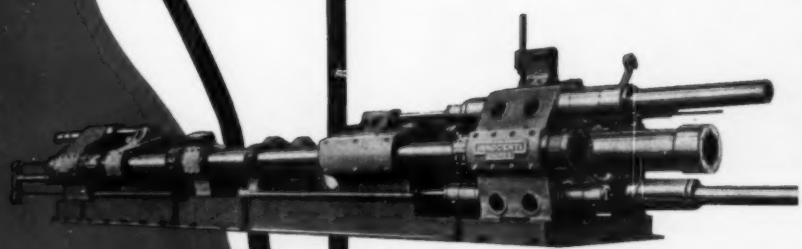
makes possible a very high yield of finished pipes in commercial sizes. The quality of the finished pipes is very high although ordinary ingots

material, are used. With an initial low investment and normal operating cost the pipe expanding equipment designed and manufactured by Innocenti is suitable to expand pipes up to 26" diameter, practically covering the entire range of commercial sizes.

extra large diameter seamless steel pipes.

INNOCENTI

(italy)



1

2

Innocenti mills are suitable for producing all types of pipes from standard gas pipes to the special A.P.I. pipes. Pilger mill and special mill for mass production of small pipes (push-bench and continuous mill) have been designed by Innocenti and installed throughout the world.

CIRCLE 209 READER SERVICE CARD

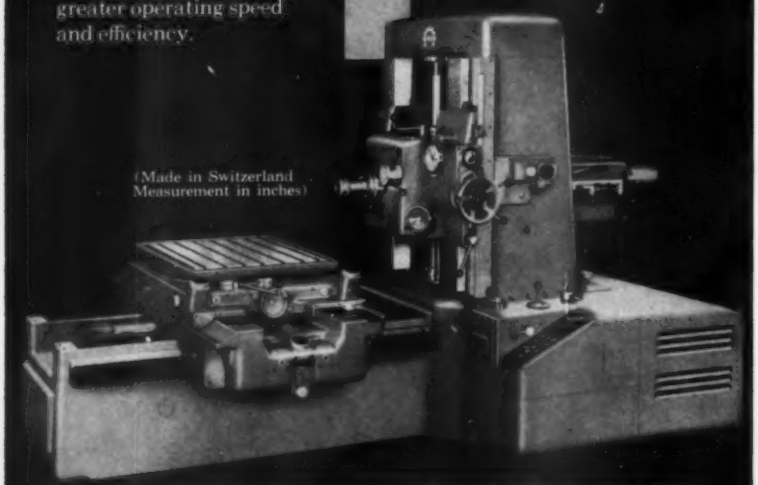
ACCURACY + VERSATILITY

the DIXI 75 gives you horizontal optical jig boring

- Projected optical setting—direct reading to .00005" for linear motions and 1 sec. of arc for built-in rotary table. Linear optics provided with adjustable zero reference.
- 3" diameter boring spindle
- Increased capacity: table size 39⅜" x 32"; 29½" cross travel; 23⅝" longitudinal travel; 25⅝" vertical travel

PLUS...

- Automatic positioning device available.
- Simplified controls functionally arranged for greater operating speed and efficiency.
- Hydraulic feeds and infinitely variable spindle speeds.
- Rear support optional.



(Made in Switzerland
Measurement in inches)

MBI has engineers available for consultation, guarantees service by factory trained staff, and stocks spare parts in New York. — Join the long list of leading aircraft and manufacturing plants throughout the United States which are using the horizontal optical jig borer.

See the Dixi 75 for the first time in U. S. A. in operation at booth 2144, National Metal Exposition, Cleveland, October 27-31.

MBI

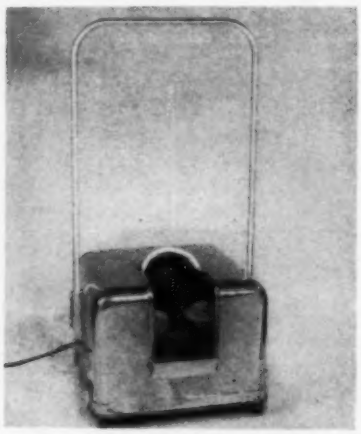
M. B. I. EXPORT & IMPORT LTD.

A DIVISION OF MACHINERY BUILDERS, INC.
475 Grand Concourse, Bronx 51, N. Y.
"Over 25 years' experience in designing and building machinery."

and bracket, is $102.50; indicating head alone, $70.

Imported by George Scherr Co, Inc, 200 Lafayette St, New York 12, NY

MORE DATA? Circle 95, inside back cover



Shoe Brushing Unit is Designed For Dust-Free Clean Rooms

The Shoe Brusher is designed for industrial applications. Any operation that calls for dust-free rooms, absence of bacteria, radiation detection, recovery of precious metals, or the maximum in cleanliness will benefit from this shoe cleaning machine. Unit is equipped with a vacuum cleaner, and is available in either a foot-actuated or electric-motor-driven model.

Liberty Machine Co 297 Seymour Rd, Berlin, Conn

MORE DATA? Circle 96, inside back cover

LEVEL AND ANGLE FINDER, known as the Emerson Combination, has a symmetrically divided protractor with a red pointer, designed for easy, direct reading. Compensating screw permits setting of angles in relation to other angles. Tool is easily zeroed-in—*Research Engineering and Sales Co, 1014 Longfellow, Royal Oak, Mich*

MORE DATA? Circle 97, inside back cover

FIELD REPORT...

Hughes Aircraft Gets $30 Million Contract

Signal Corps has given a $30.6 million order to Hughes for production of certain elements of Missile Monitor air defense systems for use by a field army. Work will be carried out at the company's Fullerton, Calif, plant.

Contract will involve a monthly payroll of $800,000 at Hughes, $125,000 monthly external purchases in the Los Angeles area, and employment of 1600 workers at maximum production. Additional 250 employees working for subcontractors will participate.

Reed Roller Bit Co...

. . . is inaugurating a broad expansion and sales buildup program calling for a capital outlay of $25 million over the next five years. About 80% of the spending is earmarked for the Houston, Texas, plant. New equipment will be installed in all departments but will primarily include "the latest in forging, turning, and heat treatment."

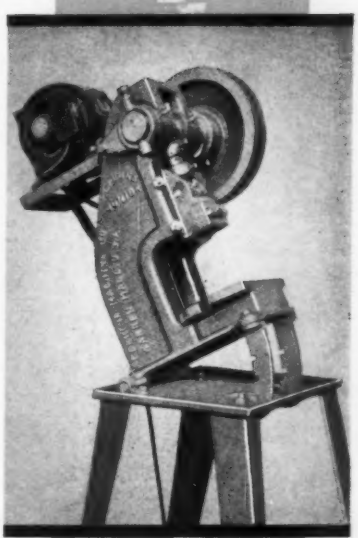
Gabriel Co May Acquire Talco Engineering Corp

Gabriel Co, Cleveland manufacturer of automotive, communication, and aircraft products, has proposed acquisition of Talco Engineering, Mesa, Ariz, producer of rocket and missile devices. Directors of both companies have approved an agreement; stockholders of both firms will now have

"Naturally . . . if you go looking for mistakes. . ."

Talon and PERKINS PRESSES

are Synonymous with *PROGRESS*



Putting ZIP into a world renown product demands an unfailing dependable source of operation at lowest possible over-all cost.

Perkins Presses have been selected by many of the nation's largest manufacturers because they represent the ultimate in press design and are built to the highest standards for strength, rigidity, endurance, accuracy and power.

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For | FORMING
BENDING
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PUNCHING, etc.

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Write us about YOUR requirements. Our engineers will be glad to help YOU.

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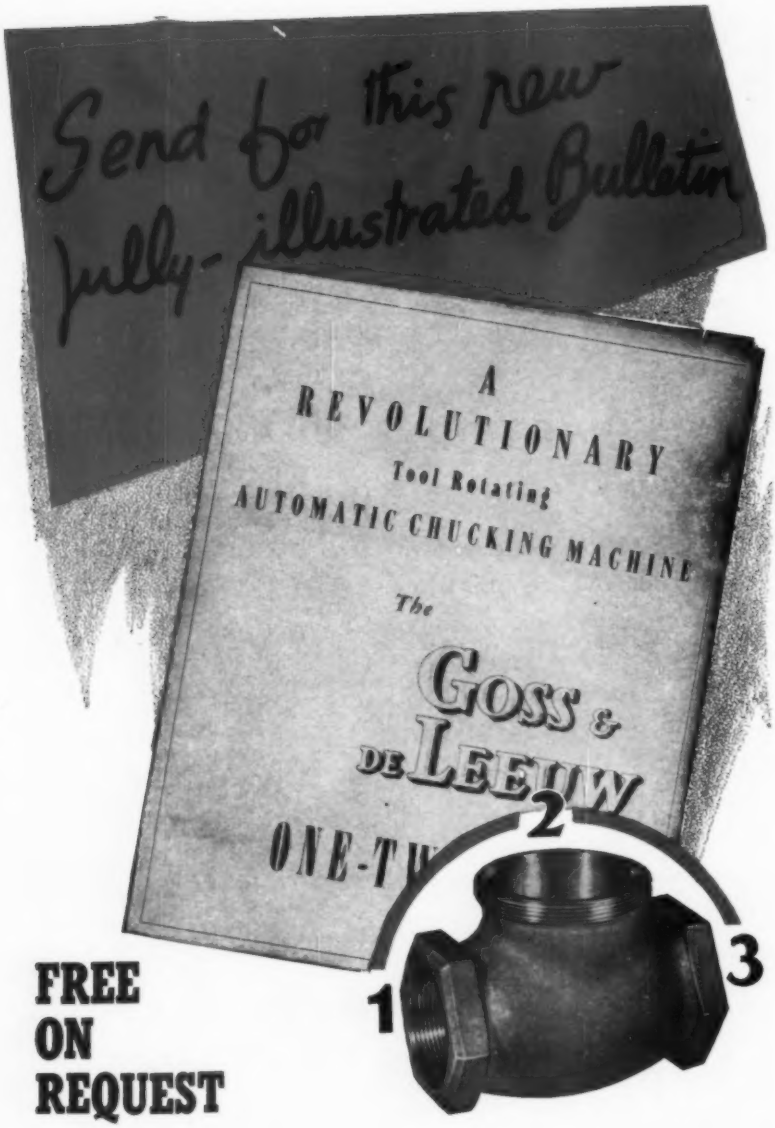
MACHINE COMPANY
WARREN, MASS., U.S.A.

CIRCLE 302 READER SERVICE CARD



FREE ON REQUEST

Here are the answers to most of your questions as to what "ONE-TWO-THREE" means in describing this outstanding development of Automatic Chucking Machines by Goss and De Leeuw. You'll be interested not only in the revolutionary design of the machine itself, but also in its extraordinary performance—and how it is possible to handle from one to three operations—in sequence or simultaneously—without changing set up.

Get this interesting, informative Bulletin NOW—by merely asking for it.

GOSS and DELEEUW
MACHINE COMPANY, KENSINGTON, CONN., U.S.A.

Field Report . . .

to approve. Earlier this year Gabriel took over the Bohanan Manufacturing Co, Los Angeles designer and maker of force ejection systems for jet aircraft.

Boeing's Dyna-Soar Team Assigned Specific Roles

Working roles and responsibilities of the nine major firms and company divisions associated with Boeing Airplane Co on the Air Force Dyna-Soar project have been allocated following AF approval of contracts. Project involves development and construction of a manned boost-glide vehicle for travel into space and back, plus study and development of the weapons system potential of such a vehicle. Boeing Systems Management Office has been awarded a competitive contract for the first-phase development of Dyna-Soar; similar contract is held by the Martin Co.

Major firms involved, and their responsibilities:

- Launching-base design development—Architectural & Engineering Div of Aerojet-General Corp, administered by Boeing's Pilotless Aircraft Div
- Pilot capsule and escape mechanisms development—Chance Vought Aircraft, administered by Boeing's Seattle Div
- Boost rocket systems development—Boost Rocket Div of Aerojet-General Corp, administered by Boeing's Seattle Div
- Tracking and telemetering system management—General Electric Co
- Reconnaissance system manage-

"Now stop worrying about the business, boss. Why, with you away there's hardly been any."

"I've never been able to assure so much protection in a chemical coolant—until now"

New HOCUT looks pure, and it is. Not only is it the best chemical cutting base from a lubricity angle—it has other outstanding merits: it cannot separate or turn rancid; it is a true *solution*—not an unstable emulsion; it has high rust preventive properties, and it helps you keep your shop clean and your machine operators happy.

And new HOCUT gives you all the advantages of a chemical coolant on all but the heaviest machining jobs. It penetrates almost instantly, cooling the work and cutting tool, preventing chip buildup and welding. A new, synthetic high molecular weight additive achieves better lubrication than most soluble oils. All this, for 6 cents a gallon, or less, in your machines.

When work comes off your machines, it's coated with a two-stage rust preventive. Why settle for less? Call your Houghton Man today—or write E. F. Houghton & Co., 303 West Lehigh Ave., Philadelphia 33, Pa. for data sheet on HOCUT 237.

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Allison Mchry. Co.—JAckson 4-1741
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IOWA
Bonaparte
Corry's Machine & Tool Co.—Phone: 112
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Austin-Hastings Co., Inc.—KIrkland 7-4480
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J. Lee Hackett Co.—TRinity 2-6442
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Minnesota Steel Supply Co.—FEderal 3-6273
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Kansas City
Ellfeldt Mchry. & Supply Co.—VIctor 2-5494
NEW YORK
New York
Federal Machinery Corp.—CAnal 6-3022
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Pacific Metal Co.—CApitol 7-0693
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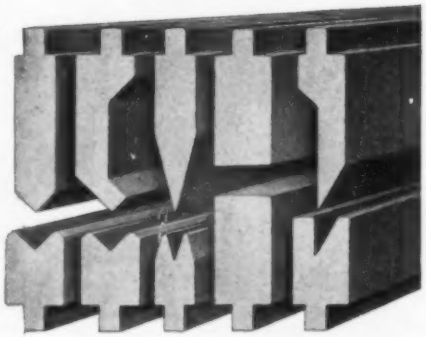


CHICAGO®
*Induction Hardened**
PRESS BRAKE DIES

This organization of local distributors offers immediate delivery on many CHICAGO *induction hardened* press brake dies. These stock dies are economical, and the quick delivery saves time in tooling. They are available in any length from 4 to 12 feet in increments of 2 feet.

Stock dies are used for a surprisingly large variety of bending operations. And, with CHICAGO *induction hardened* dies you get bonus performance and increased die life at no extra cost. Remember, these dies can be used in any make or size of standard press brake.

On your needs for press brake dies, call your nearest distributor listed here. With Bulletin D-457 you can order by number. Ask for a copy.

*Induction hardening is a special, high-frequency process used to harden the wear surfaces of CHICAGO dies. Field reports on CHICAGO *induction hardened* dies show up to ten times longer life than conventional press brake dies.

CHICAGO DREIS & KRUMP

Press Brakes, Press Brake Dies
Straight-Side-Type Presses

Hand and Power Bending Brakes
Special Metal-Forming Machines

DREIS & KRUMP
MANUFACTURING CO.
7434 South Loomis Boulevard
Chicago 36, Illinois

Field Report . . .

ment—Ramo-Wooldridge Corp
- Automatic flight and landing system management—Autonetics Div of North American Aviation
- First-stage booster development—Missile Development Div of North American Aviation
- Radio guidance system management—Avionics & Electronics Div of Goodyear Aircraft Corp
- High resolution radar development—Radio Corp of America

Boeing's Seattle Div will be responsible for assembly of the vehicle, and its Pilotless Aircraft Div for system demonstration and test.

Lindberg Industrial Corp . . .

. . . Chicago, has taken over Continental Industrial Engineers, same city. Key engineering personnel of Continental will move to the Lindberg industrial plant but will continue to operate as a separate division.

Air Reduction Sales Co . . .

. . . has started construction of a new oxygen and nitrogen plant at Denver, Colo. Facility, to cost over a half million dollars, is expected to be in operation by Jan 1.

Lapping-Polishing Service

Syntron is offering service to manufacturers whose requirements are not in sufficient quantity to warrant installation of their own equipment. The company's lab at its Homer City, Penna, facility is equipped with all five standard Syntron lapping machines plus special models which are adaptable to unusual requirements. Parts up to 37 in. max diameter can be handled.

"I don't want to worry you unnecessarily but if this part doesn't fit . . . there goes fifteen thousand dollars down the drain. . ."

Miniature Precision Bearings Adds Manufacturing Space

Addition of a 50% increase in manufacturing space at the Keene, NH, plant, makes it possible for company to offer 30-day delivery lead time on bearing orders. MPB is the largest employer in Keene with a workforce of 650. One hundred of these jobs were created by expanded production capacity. Company is currently putting up a new plant for its Split Ballbearing Div in Lebanon, NH.

Republic Steel Gets Big Pipe Order

Company has an order from the Houston Corp for 94,000 tons of 24-in.-dia pipe. It'll be used as part of a natural gas line to rim the Gulf of Mexico coast from Texas to Florida. Order, largest single one ever placed at Republic's 10-year-old Gadsen, Ala, pipe mill, will keep the plant working full-scale throughout the winter.

Howard Adds to Motor Line

Howard Industries, Inc, Racine, Wis, has acquired the induction motor line of Westinghouse Electric Corp of Lima, Ohio. Equipment will be moved to the Racine plant. Late last year Howard bought the Westinghouse Motor Division, moved that equipment to Racine, also.

Bendix Aviation Corp's...

. . . York, Penna, Division has a $1.7 million contract for development and production of the warhead proximity fuze for the new Bomarc IM-99B guided missile. This is the advanced version of Air Defense Command's pilotless interceptor now being developed by Boeing.

Liberty Coach Co...

. . . Bremen, Ind, will begin production late this year in Columbus, Ga, in a $300,000 plant. Initially it'll employ 150 with annual payroll of about half a million dollars.

Jones & Laughlin to Spend $35 Million on Improvements

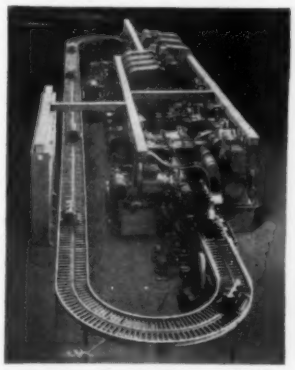
The steel corporation reports that it will spend $20 million on a program of beneficiating iron ore. Other $15 million will go for 59 new by-product coke ovens at the Pittsburgh works,

STEEL *from Wheelock, Lovejoy* BULLETIN

W-L DETROIT For the first time, HY-TEN D-2 air hardening steel now available here in rounds, squares, flats and billets. Also a fine stock of standard alloy grades, especially A-8620, as well as all HY-TEN grades. Excellent service from our new warehouse.

W-L CHICAGO Steady demand for "B" No. 3X for flame-hardened parts such as boring bars. Good stocks of HY-TEN AIS — the best carburizing alloy steel, and freest machining available today—a new W-L exclusive!

W-L CINCINNATI This 23-station Avey Line-O-Dex transfer machine, designed and built by The Avey Division of Motch & Merryweather Machinery Co., Cincinnati, Ohio, is equipped with spindles made of our HY-TEN "B" No. 2. This grade was chosen for its great tensile strength (100,000 P. S. I. in the natural condition), toughness, and fine wearing qualities.



W-L CAMBRIDGE We are now distributing FLEXANGLE, the easy-to-erect structure assembly for all types of racks, shelves, platforms, etc. It's completely universal and low in cost — can be used anywhere, by anyone, for any storage purpose.

W-L HILLSIDE Our stock of flat and square sizes in HY-TEN M Temper Oil Hardening Steel can save you time and money in your tooling program. HY-TEN "B" No. 3X pre-heat treated in rounds, squares and flats available in a wide range of sizes. Billets on hand for hammer forging in all grades of HY-TEN.

W-L CLEVELAND Excellent stock of brake die flats and squares. Also many sizes up to 16" x 18" in HY-TEN Mold Steel. Excellent deliveries.

W-L BUFFALO A wide range of rounds and hexagons in cold drawn AISI leaded and non-leaded A-4140. Also many sizes of the new "B" No. 3X-40 in rounds and hexagons.

Write our Cambridge office today for your *free* Wheelock, Lovejoy Data Sheets. They'll give you complete technical information on grades, applications, physical properties, tests, heat treating, etc.

WHEELOCK, LOVEJOY & COMPANY, INC.
137 Sidney Street, Cambridge 39, Mass.

AMERICAN STEEL WAREHOUSE ASS'N

AGENTS: Southern Engineering Company, Charlotte, N. C.; Sanderson-Newbould, Ltd., Montreal & Toronto

CIRCLE 306 READER SERVICE CARD

The Inside Story of a Finer Pump...

Electro-magnetically balanced rotor cuts vibration, prolongs bearing life.

No seal

NOTE—

Fewer parts and to wear repair.

No packing or priming needed

Heavy duty pre-lubricated ball bearings require no further attention.

Model 11023E

Built Better to wear longer — Write for our complete catalog. There's a type and model to suit you.

THE Ruthman MACHINERY CO.

- COOLANT PUMPS
- CIRCULATORS • AGITATORS
- MOLTEN METAL PUMPS

1819 Reading Road, Cincinnati, Ohio

Field Report . . .

a new iron ore sintering plant, ore screening facilities, and a continuous annealing line for tin plate at Aliquippa. Firm says it decided to go ahead with the projects because of improved business conditions.

Electro Mechanical Products . . .

. . . Garden City, Mich, company that makes auto accessories and electronic equipment, has leased a 33,000 sq-ft building in LaFollette, Tenn, expects to employ 100 workers within the next couple of months.

Rohr Aircraft Reports . . .

. . . that commercial business now accounts for more than 60% of its total $245 million backlog. Most of the increase in the company's commercial backlog is due to orders from Lockheed for power packages for the Electra propjet airliner.

Eversman Manufacturing Co . . .

. . . has formed a special products division at its Denver headquarters to handle steel and plate forming, fabrication and assembly of all types including machine tool production.

Aeronca Manufacturing Corp Forms LA Subsidiary

Aeronca, Middletown, Ohio, has signed an agreement with Pastushin Aviation Corp of Los Angeles calling for acquisition of the latter's entire

"The raise in salary will become effective just as soon as you do."

manufacturing equipment and the lease of its plant there with an option to buy. Newly-acquired facility, to be known as Aeronca-California Corp, makes large tanks for military aircraft. The Ohio company is a major supplier of large subassemblies for heavy military and commercial aircraft.

Line Material Industries . . .

. . . Birmingham, Ala, has completed installation of new equipment to produce a line of products for electrical transmission and distribution systems. In addition, power switching equipment previously manufactured at the company's Milwaukee facilities is now being produced at the Birmingham plant.

Mech-Tronics Corp . . .

. . . Melrose Park, Ill, has bought 55 acres in Deer Valley north of Phoenix, plans to put up an electronics plant that'll have an initial 30,000 sq ft of floor space and workforce of 100. Eventually the facility will contain 100,000 sq ft and employ 350. Firm does $1 million worth of aircraft and missile component manufacturing annually at the Melrose Park plant which will continue operations.

Daystrom Buys Gage Firm

Business and assets of Industrial Gauges Corp, West Englewood, NJ, have been acquired in a cash transaction by Daystrom, Inc, Murray Hill, NJ, electronics manufacturer. Company, which makes sensing and analytical devices, will be known as the Industrial Gauges Dept of Daystrom-Weston Industrial Division.

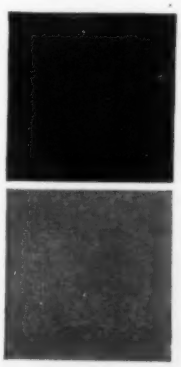
Sunbeam Corp . . .

. . . has purchased the Meadville, Penna, factory of Westinghouse Electric Corp and will transfer its Sunbeam-Steward Furnace division from Chicago to that city. The Chicago plant will be used for an expanding line of products, and layoffs in the Chicago area as a result of the move will be negligible.

Temco Aircraft Awarded More Navy and Air Force Contracts

Follow-on orders exceeding $9 million for components of Navy and Air Force jet fighters have been received by Temco Aircraft, Dallas, from McDonnell Aircraft, St Louis. The or-

SHOW STOPPER



It's the new Torrington Verti-Slide, the first major innovation in the field of 4-SLIDE equipment in 50 years!

This machine was designed to meet a growing need for greater productivity and profitability in the cost-critical area of wire and strip forming.

Seldom before has a new machine created such immediate and widespread interest. We urge you to get the full story. Write or call today.

THE TORRINGTON MANUFACTURING COMPANY

TORRINGTON, CONNECTICUT · VAN NUYS, CALIFORNIA · OAKVILLE, ONTARIO

CIRCLE 308 READER SERVICE CARD

WITH Lipe Automatic
Magazine Loading Bar Feeds

*says Production Supervisor J. H. Lindsey**

● When we were asked to cut costs to meet or beat competition five months ago, we decided to give the Lipe A.M.L. Bar Feed a try. We had heard that this feeding device enabled screw machines to deliver more than 90% of gross geared capacity. We had never done better than 75% with ours, even when new. In the first full week of bar feed operation, the machine to which the A.M.L. was attached *produced 146% more pieces than it had ever turned out before!*

● The A.M.L. fed stock *continuously,* with no repeat motion for feedouts . . . no down-time for changing feed-fingers, or for remnant disposal. There was no cutting air—and when you stop cutting air, you start cutting costs.

● As a result of this test, we installed an A.M.L. on every screw machine in the production line, with the exception of those we were able to eliminate because of the overall increase in output. When we come to install new machines, the A.M.L.'s will be there to develop *their* extra potential.

Write or Wire for a FREE Lipe Sales Engineering estimate of production increases, savings and amortization time of Lipe A.M.L. Bar Feeds in your production layout.

*Photographer's models and pseudonyms used to protect company identity and confidential information.

Lipe-ROLLWAY CORPORATION SYRACUSE 1, N. Y.

Manufacturers of Automotive Clutches and Machine Tools

Field Report . . .

ders are for aft fuselages for the Air Force's F-101 Voodoo fighter-interceptor, and for aft fuselages, wings and slats for the F3H Demon, a Navy carrier-based jet interceptor.

Quality Control Conference

Twelfth Annual New England Quality Control Conference will be held in Pittsfield, Mass, at the Wendell Sherwood Hotel on Oct 30 and 31. Program includes seminars led by top industrial consultants, 32 technical sessions, and a coordinated education program covering techniques and theory of quality control. For further details, contact Carl W Nickerson, c/o Wentworth Institute, Boston 15, Mass.

New Chemical Company

Hampshire Chemical Corp has begun production in a new plant at Nashua, NH. It'll turn out chemical specialties including nickel and copper stripping compounds and synthetic amino acids.

Phillips Aviation Co . . .

. . . has acquired Marples Gears. Both firms are headquartered in Pasadena, Calif. Marples, a producer of precision fine pitch instrument gears, will be operated as a wholly-owned subsidiary of Phillips, manufacturer of machine parts and electro-mechanical components for aircraft and missiles.

"I put everything in my wife's name—and now she's packed up and gone home to her mother."

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

MACHINES AND ATTACHMENTS

1 TOOL AND DIE MILLING MACHINE—*Cincinnati Milling Machine Co, Cincinnati 9, Ohio.* 6-page illustrated bulletin M-2008 gives details on the 1-C Contourmaster with 3-D hand-guided tracer mechanism for accurate duplication of master shapes or profile templets. Spindle speeds are 215 to 5650 rpm. Dimensional drawings, specifications, design features covered.

2 MILLING MACHINE — *Sundstrand Machine Tool Co, 2531 Eleventh St, Rockford, Ill.* 8-page bulletin C1 contains illustrated description of the C1 mechanical-feed Rigidmil. Spindle speeds are from 34 to 2024 rpm in three ranges; feed range is ¾ to 75 ipm; max feed strokes available, 18, 24, or 30 in. Includes data on table cycles, construction features, attachments, specifications.

3 HYDRAULIC HOT PRESSES — *Berthelsen Engineering Works, Inc, Box 1428, Lockport Rd, Joliet, Ill.* 16-page brochure describes and pictures construction features and applications of units built to specific requirements.

4 POWER PRESSES—*Federal Machine & Welder Co, Warren, Ohio.* 20-page bulletin WARCO 52151 illustrates and describes types of power presses and provides suggestions on selection. Covers pressworking of metals with inclusion of tables, charts, and pertinent data.

5 TOOLROOM SHAPER—*Jersey Manufacturing Co, 407 Livingston St, Elizabeth 1, NJ.* Illustrated literature describes Model H-20, guaranteed for an accuracy of ±0.0004 in. for 6 in. Revolving table permits immediate setup of a variety of operations. Accessories pictured, technical data included.

TOOLS AND ACCESSORIES

6 HOLDING DEVICES — *Heinrich Tools, Inc, Racine, Wis.* 28-page illustrated catalog 158 provides complete description of full line of screwless, fast production vises and automatic self-centering air vises. Includes tool application problems and solutions, operation and maintenance instructions, blueprints, and dimension tables.

7 SPECIAL PRODUCTION TOOLS—*McCrosky Tool Corp, Meadville, Penna.* 16-page catalog S-19 contains illustrated description of wide variety of tools specially designed to combine 2, 3, 4, or more related machining operations, performing them at the same time. Multiple-operation tools combine two or more related boring, facing, chamfering, and reaming operations with one setup. Also covers single operation special tools engineered for unusual machine and work conditions.

8 MARKING TOOLS AND MACHINERY—*Geo T Schmidt, Inc, 4100 N Ravenswood Ave, Dept AM, Chicago 13, Ill.* 192-page catalog 16 contains illustrated sections on engraved stamping dies; type and type holders; embossing and coining dies; hand stamps; nameplate marking tools; numbering heads; hand, pneumatic, hydraulic, and mechanical marking machines; automatic feeds; tools for every marking application.

9 STRAIGHT SHANK TWIST DRILLS —*Union Twist Drill Co, Athol, Mass.* 4-page bulletin gives tabular data on fast spiral, taper length HSS List No. 520, specially designed for use through long bushings, or where extra length is required. Drills are furnished in fraction, wire gage, and letter sizes.

FREE BROCHURE TELLS HOW YOU CAN GRIND PRECISION HIGH PRODUCTION DIES

IMPORTANT TO YOU!

Free booklet tells how VISUAL GRIND facilitates construction of precision high-production dies, dies for powder metallurgy, lamination dies and special purpose dies. VISUAL GRIND permits through, blind and templet grinding . . . permits continuous inspection by magnifying work from 10:1 to 100:1 . . . upgrades semi-skilled labor . . . permits easy maintenance of dies in your own plant . . . reduces costly down time. VISUAL GRIND COMPLETES YOUR TOOL ROOM.

Visual Grind solves the problem in mind

Intricate grinding jobs like those shown above ordinarily involve several machines. ALL WERE FORM GROUND ON A SINGLE VISUAL GRIND.

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Please send me the free brochure describing the capabilities of the VISUAL GRIND.

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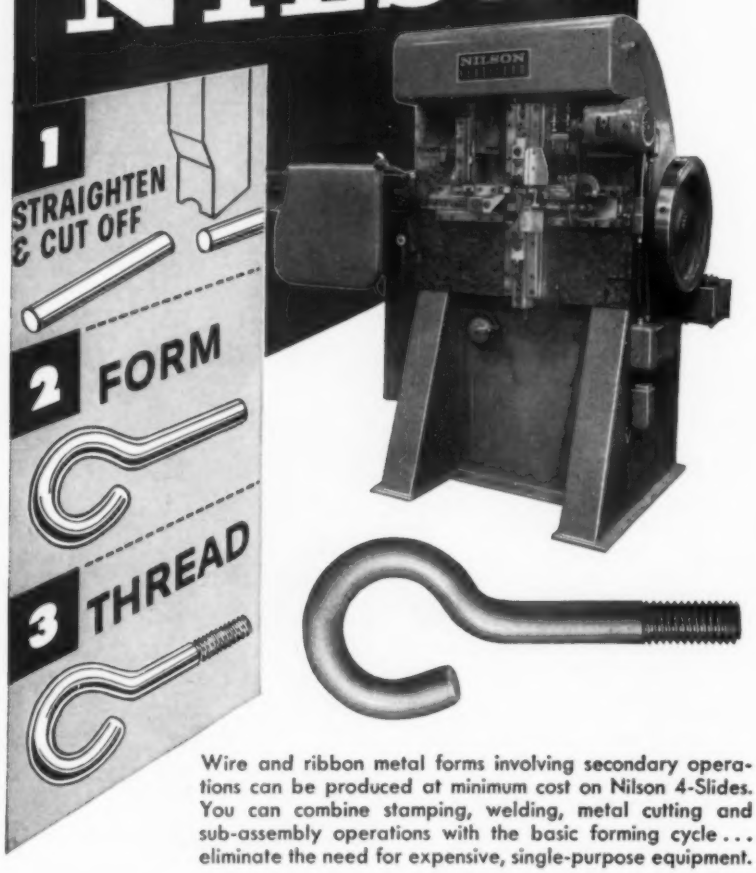
NILSON 4-SLIDES FORMING PRODUCTION PROFITS... *Automatically*

COMBINE OPERATIONS on a NILSON



Wire and ribbon metal forms involving secondary operations can be produced at minimum cost on Nilson 4-Slides. You can combine stamping, welding, metal cutting and sub-assembly operations with the basic forming cycle . . . eliminate the need for expensive, single-purpose equipment.

The Nilson "Vertiform" shown above, for example, has a die head mounted on the right-hand forming slide. Wire stock is straightened, cut off, formed and threaded—all automatically in one cycle!

In addition to the new "Vertiform," Nilson builds 17 models of horizontal 4-slides, including 5 ribbon metal machines with built-in press units. For a new approach to low-cost production of wire forms and small metal stampings, it will pay you to get in touch with Nilson.

Send today for the Nilson General Catalog on Automatic 4-Slide Equipment!

NILSON
THE A. H. NILSON MACHINE CO.
501 Bridgeport Avenue • Shelton, Conn.

AUTOMATIC WIRE & RIBBON METAL FORMING 4-SLIDE MACHINES • WIRE & STOCK REELS • WIRE STRAIGHTENING EQUIPMENT • AUTOMATIC STAPLE FORMING MACHINES • SPECIAL WIRE FORMING EQUIPMENT

10 ELECTRONIC GO-NOGO GAGE—*Computer Measurements Corp, 5528 Vineland Ave, North Hollywood, Calif.* 4-page bulletin contains information on Series 620 instruments designed for frequency stability and comparison checks, motor speed control, pressure and flow control, material flow control, and other limiting situations occurring between 1 and 40,000 times per second.

11 MACHINE BIT—*General Electric Co, Metallurgical Products Dept, 11177 E Eight Mile Rd, Detroit, Mich.* Catalog and specification sheets describe the new CC-11 that incorporates 1½-in. gage for added rigidity. Shorter gage reduces leverage of the cutting forces which cause shank bending or breakage.

12 CORRECT TOOL SHARPENING—*Heald Machine Co, 3 New Bond St, Worcester 6, Mass.* 32-page illustrated booklet (No. 13-25-14) points up three ways of destroying the effectiveness of boring machines or other equipment using single-point tungsten carbide cutting tools. Solution describes use of Heald tool sharpeners to eliminate damaging effects and inaccuracies.

13 HELIXPOINT DRILLS — *Steptool Corp, 3613 E Olympic Blvd, Los Angeles 23, Calif.* 4-page bulletin illustrates and describes drills as produced on the Steptool relief grinding fixture. Presents two case histories of performance; gives details on grinding fixture used for producing Helixpoints on drills from No. 80 through 1-in. dia. Three-eighths drills can be ground at 120 per hr. Fixture also permits sharpening core drills, step drills, countersinks, and taps, and can be used on any surface grinder or tool grinder.

14 CAST FORGING DIES AND AUXILIARIES—*E W Bliss Co, Mackintosh-Hemphill Div, 901 Bingham St, Pittsburgh 3, Penna.* 4-page bulletin 56 discusses cogging hammer dies, cogging press dies, sow blocks, and anvil bases with suggestions on selecting the proper surface hardness and alloys.

15 CARBIDE GUN DRILLS—*Star Cutter Co, PO Box 376, 34500 Grand River Ave, Farmington, Mich.* 4-page illustrated bulletin SC-110 gives information on Starbore line that produces smooth, precision through-holes in cast iron, aluminum, bronze, and some steel parts. Application data, construction, maintenance, specifications, machine tool requirements, and coolants included.

16 STRAIN GAGE PRESSURE TRANSDUCERS—*Gulton Industries, Inc, Instrumentation Div, 212 Durham Ave, Metuchen, NJ.* 4-page illustrated technical bulletin series PSG-1 presents data on gage, absolute, and differential pressure measurements. Describes Glennite units covering performance, application, mechanical and electrical specifications, compatibility in installations, and ordering information. Includes circuit diagrams, typical installation, and basic explanation of operation of equipment.

17 PNEUMATIC DRILLS—*Air Speed Tool Co, 1502 W Slauson Ave, Los Angeles 47, Calif.* Illustrated bulletin covers nine types including light-weight, high-speed, and heavy-duty models. Specification table included.

18 BANDSAW—*L S Starrett Co, Athol, Mass.* 4-page illustrated bulletin 1069 describes Safe-Flex HSS unit; gives recommendations for use and specifications covering blade sizes and pitches available in hook-tooth, regular, and skip-tooth types.

PLANT SERVICE EQUIPMENT

19 CONVEYORS AND SYSTEMS — *Conveyor Specialty Co, 33 Newport Ave, North Quincy 71, Mass.* 6-page bulletin illustrates and describes complete line of Unibilt power and gravity units. Ex-

FINE PATTERN on 11" diameter "plunger" forms molding surface for press to make abrasive wheels. The Carborundum Company.

Airkool-S retains precise size and shape through heat treatment

Forming this precise pattern is easily accomplished with Airkool-S, a tough, sulphur-bearing, air-hardening tool and die steel with good machinability. Its excellent nondeforming properties are important too, because this pattern must be retained, without distortion, through heat treatment.

Because Crucible Airkool-S is consistently uniform and clean, no objectionable irregularities appear on this fine pattern. Furthermore, Airkool-S is much more abrasion resistant than typical oil-hardening tool steels, and is substantially tougher than high-carbon, high-chromium types.

Stocks of Airkool-S and dozens of other special tool steels are maintained in all Crucible warehouses—in a wide range of sizes. *Crucible Steel Company of America, Dept.* ***TH01,*** *The Oliver Building, Mellon Square, Pittsburgh 22, Pennsylvania.*

CRUCIBLE STEEL COMPANY OF AMERICA

Canadian Distributor—Railway & Power Engineering Corp., Ltd.

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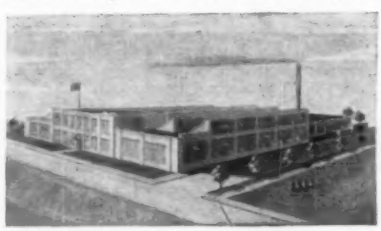
. . . because CDT specializes in designing and building tools and machines for today's high production demands.

CDT CAN IMPROVE YOUR QUALITY
. . . because CDT tools, jigs, fixtures and machines are precision engineered and built to the strictest requirements.

CDT CAN LOWER YOUR PRODUCTION COSTS
. . . by increasing the efficiency of your operation with special tools that do the job better—faster—more economically.

Call on Columbus Die-Tool for your special tooling problems. A large creative engineering staff with experience in developing special tools and machines for hundreds of industries is at your service. Over 50,000 square feet filled with precision production equipment enables us to build fine tools and special purpose machines to exacting requirements. Avail yourself of the industry-wide experience of Columbus Die-Tool.



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Designers and manufacturers of JIGS • FIXTURES • SPECIAL TOOLS • UNITS FOR MACHINE TOOLS • *also Builders of Machine Tools Complete*

Free Literature

To order any of these bulletins, circle corresponding number inside back cover.

plains "assemble-it-yourself" construction, outlines details of engineering service, includes sketch of typical 2-floor conveyor system.

20 PUMP—*Borg-Warner Corp, Pesco Products Div, Bedford, Ohio.* 4-page illustrated bulletin describes operation of the VIEP, a variable displacement internal-external unit. Advantages, applications, zero displacement operating position, and full displacement operating position pictured.

21 HAND-OPERATED CRANES — *American Chain & Cable Co, Wright Hoist Div, York, Penna.* 4-page folder DH-455-B contains technical data, specifications, operating features, and capacities of Type B-36 underslung single bridge unit. These cranes have capacities of 1 to 10 tons and are available in spans up to 50 ft in length. They are furnished with any Wright hand or electric trolley hoist, or hoist and trolley of similar capacity.

22 ADJUSTABLE STORAGE RACKS—*Palmer-Shile Co, 16019 Fullerton, Detroit 27, Mich.* 6-page folder illustrates variety of applications for racks custom-built for any storage requirement for use in single, double, or multiple sections. Only two parts need be assembled, without bolting or welding.

23 REPLACEMENT BRUSHES—*Ohio Carbon Co, Dept 219, 12508 Berea Rd, Cleveland 11, Ohio.* 6-page brochure presents illustrated description of motor brushes for electric fork trucks and other materials handling equipment. Ready identification is provided by size and part number; replacements apply to variety of makes of trucks.

24 LIGHTING—*General Electric Co, Dept RL-58, Nela Park, Cleveland 12, Ohio.* 16-page booklet contains information on GE's simplified group relamping plan which is based on predictability of lamp life, and replacement before dim-out infringes on maintenance costs. Illustrated with photographs, charts, tabular data.

25 FORK LIFT TRUCKS — *Allis-Chalmers Mfg Co, Engine-Material Handling Div, Milwaukee, Wis.* 4-page booklet BU-481 presents illustrated description of features of GS-approved trucks in the 3000 to 10,000-lb capacity range. Fire-safe trucks are designed to work in presence of ignitible fibers, combustible dusts, flammable liquids and vapors, and other hazardous areas.

26 COATING COMPOUNDS—*MacDermid Inc, Waterbury, Conn.* 4-page technical data sheet No. 76 discusses group of compounds called Maccromates for producing chromate conversion coatings on zinc and cadmium plated work, on zinc diecastings, and on aluminum.

27 SAFETY SOLVENTS—*Fine Organics, Inc, 211 E 19th St, New York 3, NY.* Revised specification sheets on expanded line of Safetee Solvents, bound in catalog form, cover new applications, plus specifications for each product.

28 METAL DEGREASING—*L Sonneborn Sons, Inc, 300 Fourth Ave, New York, NY.* Bulletin 132 discusses use of three types of emulsion cleaners: stable, two-phase, and soak. Range of applications covered.

29 ELECTROPLATING FILTRATION —*Commercial Filters Corp, 2 Main St, Melrose 76, Mass.* 4-page bulletin GEO-508 presents illustrated explanation of use of Fulflo Filters with Honeycomb Filter

Tubes, said to provide tank turnover up to 3 times per hr. Filters for electroplating, water, and compressed air are pictured and described. New stainless steel filter also covered.

30 BARREL FINISHING—*Almco Div, Queen Stove Works, Inc, Albert Lea, Minn.* 52-page handbook describes equipment, including machines for processing subminiature parts.

PARTS AND MATERIALS

31 HEAVY-DUTY LIMIT SWITCHES—*National Acme Co, Electrical Mfg Div, 170 E 131st St, Cleveland 8, Ohio.* 12-page illustrated bulletin EM-5824 describes Snap-Lock Series D-2400 incorporating double pole-double throw, two normally open-two normally closed contact design. Covers design and construction features, styles and sizes of the operating levers available.

● SERVO VALVES—*Moog Valve Co, Proner Airport, East Aurora, NY.* 6-page illustrated catalog 210 gives details on line of low-flow units; includes curves and schematics that point up design and performance characteristics of these valves which are particularly suited to applications requiring precise control at high power levels. Request direct on company letterhead.

32 GEARSHIFT DRIVE—*Lima Electric Motor Co, Dept 132, Lima, Ohio.* 8-page bulletin OEM-DB illustrates and describes construction and typical applications; pictures original equipment applications, gives comparative data between Lima Selective-Speed drives, and other types.

33 "MAGNESIUM IN THE ELECTRONICS INDUSTRY"—*Dow Chemical Co, Magnesium Dept, Midland, Mich.* 20-page illustrated booklet describes applications in this field. Describes pertinent properties such as light weight, temperature resistance, damping capacity, and finishing systems.

34 ELECTRICAL SWITCHES—*Illinois Tool Works, Licon Div, 2501 N Keeler Ave, Chicago 39, Ill.* 32-page catalog (Form 5208) illustrates and provides detailed information on complete line including new subminiature pushbuttons and limit switches, pulsing limit switches, and specialized devices. Contains technical data, diagrams, ordering information; discusses applications, includes price list.

35 SEALED RELAYS—*General Electric Co, Schenectady 5, NY.* 24-page bulletin GEA-6628 contains data on hermetically sealed units for military and general purpose applications. Circuit diagrams, photos, coil data, specifications for micro-miniature, sub-miniature, miniature, and high-speed relays included, as well as ordering information.

36 TOOL STEELS—*Uddeholm Co of America, Inc, 155 E 44th St, New York 17, NY.* Expanded stock list No. 13 includes two high-carbon, high-chrome, oil hardening materials; information and stock sizes on HSS toolbits, hardened and finish ground; comparable brand name chart of 13 different tool steel producers; temp-conversion chart; tables of wire and sheet metal gages; tool steel selector and properties guide.

37 PVC PIPE AND FITTINGS—*Carlon Products Corp, 10825 Mesch Ave, Cleveland 5, Ohio.* 16-page manual PVC-100 gives detailed information for selection and application of complete line of polyvinyl chloride pipe, tubing, and fittings. Covers both normal and high-impact PVC; data on comparative costs of PVC and comparable metal piping; includes mechanical, thermal, and electrical properties; pipe and tubing sizes and specifications; fitting types, sizes, and dimensions.

6 CENTS PER DAY BUYS A LO-HED® HOIST

"Although this hoist is over 32 years old, it is still doing an excellent job. Cost of maintenance is next to nothing. A recent inspection would seem to indicate that the hoist will be good for another 32 years."

Said by John Vengoechea, Maintenance Superintendent, Edgcomb Steel Company, Philadelphia, Pennsylvania, (seen on the left above, talking to Ed Boyer, Sales Manager, A-E's Materials Handling Division.

Lo-Hed Electric Hoists Cost Less Because They Last Longer

Based on current prices, this Lo-Hed Hoist at Edgcomb Steel shows a capital cost of less than 6 cents per day... and it looks like it will still be going strong in 1990.

There's A Lo-Hed Electric Hoist Exactly Right For Your Application

Just give us the details! Lo-Hed's are available with headrooms as low as 11"; capacities ¼ to 12 ton; all control types, two-speed included; 5 suspensions; also adaptable to any crane or monorail system; shrouded bottom block; 2 automatic brakes, anti-friction bearings throughout, full load tested. Look in your classified telephone directory under "A-E Lo-Hed Hoists" for your nearest representative.

For helpful information on hoists, fill out and mail this coupon today.

Please send me a copy of your booklet on:

☐ "How to select the proper hoist to meet your needs."

☐ "Five things to consider before you buy that hoist."

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Company.....

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10171

DISTRIBUTORS AND AGENTS: Distributorships and agencies for Lo-Hed Electric Hoists are available in many parts of the country. If you are interested, call or write Ed Boyer, Sales Manager, A-E's Materials Handling Division.

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Branch Offices: Jersey City • Cleveland • Chicago

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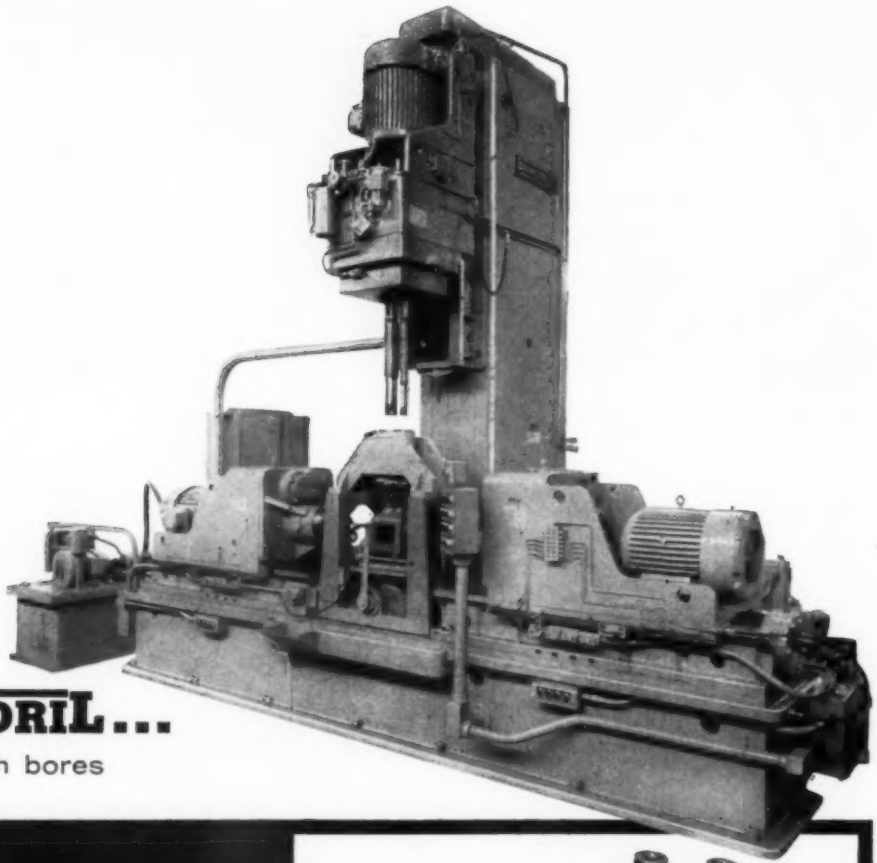

BARNESDRIL...

rough and finish bores

10 different parts on one machine

These are samples of ten different crankcases, rough and finish bored on the same special Barnesdril 3-Way Unit Machine. This machine is engineered to handle all parts, using 2 fixtures with interchangeable top and lower plates. Machining flexibility is arranged through one single spindle adapter-type boring heads and five 2-spindle boring heads.

Such production flexibility furnishes a high rate of parts production, with minimum cost per part. Changeover part to part is simple and fast, either by changing complete fixture or substituting plates or spacers, with suitable boring heads. Machining *both* rough and finish bores of ten *different* parts on the one machine cuts direct labor and machine costs.

If you have parts requiring high speed automatic production, consult Barnesdril engineers for methods combining a number of different parts on a single machine. A full range of cycle operations are available, with cycle time engineered to meet production requirements. Send parts or prints for estimate.

The facts are free... complete data on production flexibility obtained with Barnesdril special machines is found in this new Bulletin 1504. You may have a copy free upon request on company letterhead. Send for one today.

BARNES DRILL CO.

830 CHESTNUT STREET • ROCKFORD, ILLINOIS

DETROIT OFFICE: 13121 Puritan Avenue

Alford H Johnson (left) has been appointed sales manager for the Cutting Tool and Gage Division of Pratt & Whitney Co, Inc, West Hartford, Conn. He was formerly located in Chicago as sales manager of the Mid-Continent territory. **William C Mullin** (right) has been named manager of instrument gage sales for the entire country. He previously directed sales of these products for the East-West territory only. **A F Miller Jr,** East-West regional sales manager for cutting tools and conventional gages, has resigned

Edward J Henkel has been appointed a director of Swift Engineering Co, Royal Oak, Mich, and vice president in charge of the Production Equipment and Die Design Division. He was formerly vice president, engineering and sales, and a founder of Lamina Dies & Tools, Inc, Oak Park and Bellaire, Mich

NAMES IN THE NEWS...

Sheldon E Young has been promoted from general manager to executive vice president of the Barrymount Corp, Chicago subsidiary of Barry Controls, Inc.

Robert H Gathman has been appointed general manufacturing manager of GM's Fisher Body Division. He succeeds **E J Hanson** who will be on special assignments reporting to the division general manager. Mr Gathman was previously manager of the metal stamping plant at Mansfield, Ohio; he is succeeded there by **Edward H Goebel,** formerly senior staff assistant in the Master Mechanics Section in the Detroit general offices. Additional appointments: **Raymond O Doss,** assistant, to manager of Fisher Body Plant No. 1, to succeed **Ralph Nordyke,** named general manufacturing manager of the Michigan body assembly plants; **Frederick H Hanson,** general factory manager, to be in charge of Fisher plants in the western states; and **Carl W Moyer,** general factory manager of Michigan plants, to be in charge of Fisher plants in the eastern states.

Edward E Kennie has joined Southworth Machine Co, Portland, Me, as coordinator of engineering and manufacturing for the company's Lift Table Division. He was formerly superintendent of production and coordination at Continental Copper & Steel Industries, Inc, Walsh Holyoke Division.

James R Parr has been appointed vice president and chief engineer of American Industries Co, Bristol, Penna, manufacturer of precision hydraulic products. He was formerly hydraulics engineer for product research and development at American Engineering Co, Philadelphia.

John S Jackson has been elected president of Shepard Niles Crane & Hoist Corp, Montour Falls, NY. He succeeds **Sydney Buckley,** named board chairman. **Herbert Gledhill** has been named vice president and general sales manager, posts formerly held by Mr Jackson.

John T Page has been made vice president and general manager of Cascade Manufacturing Co, Portland, Ore, manufacturer of hydraulic attachments for the lift truck industry and of hydraulic cylinders.

Robert C Strassman, secretary and treasurer of Badger Die Casting Corp, Milwaukee, has been elected president of the American Die Casting Institute for the 1959 term. **Gordon C Curry,** sales manager of Dollin Corp, Irvington, NJ, has been elected vice president of the Institute.

Leete P Doty has been named assistant general manager of United Aircraft Corp's Sikorsky Aircraft Division, Stratford, Conn. He was previously a senior production executive at the Pratt & Whitney Aircraft Div.

Arthur J Raymo has been appointed factory manager of the Eddystone (Penna) Division of Baldwin-Lima-Hamilton Corp. He was formerly associated with General Electric Co as consulting manufacturing engineer of the Atomic Power Equipment Dept in San Jose, Calif.

Frederick E Fauth has been appointed chief engineer of Crown Cork & Seal Co's Machinery Division. He was previously chief engineer of packaging machinery.

John T Bennett has been named sales manager of Gorham Tool Co, Detroit maker of high speed steel and carbide tipped cutting tools. He was formerly midwestern district manager.

Dr William H Schuette has been elected a vice president of Dow Chemical Co. He will continue to serve as general manager of the Midland, Mich, Division. **Herbert H Lyon** has been promoted from controller to manager of the Madison (Ill) Division; he succeeds **Hubert Fruehauf,** recently named manager of Dow's new magnesium products department.

L K Stringham, recently resigned vice president in charge of engineering for Lincoln Electric Co, Cleveland, has joined the Emerson Electric Manufacturing Co of St Louis as vice president, research and development.

CLAUSING (COLCHESTER) GEARED-HEAD LATHES

HERE'S PROOF OF PERFORMANCE *from Anderson Duggar, Jr., president of Equitable Engineering Co. — "How do we like our Clausing 15" geared-head lathe? We want another just like it! Our people really surveyed the market thoroughly before deciding on the Clausing — believe me, it's everything it looked to be and more. The Clausing is an extremely accurate lathe and its features and ease of operation are making us money."*

Clausing geared-head lathes do lead their field in capacity, performance and value. Here's why:

They're bigger in capacity than other lathes in their class. Larger spindles, larger thru-hole capacity, larger bearings for heavier work. 17" lathe spindle, for example, has 3-1/16" thru hole — 15" lathe, 2-1/16" hole — 13", 1-9/16" hole.

Have heavy-duty construction throughout. Bed ways are induction hardened. Gears in head and quick-change box run in bath of oil. Power feeds are taken from separate feed rod, lead screw is used for thread cutting only. Spindles are high-tensile steel.

Built for precision performance — to American standards of toolroom lathe accuracy. Have Gamet Micron tapered roller bearings with oil flow lubrication — the most advanced and accurate bearings known to industry.

Each is an outstanding value. 13" cabinet base models, including motor and controls, start at $2113; 15" cabinet base at $2988; 17" at $4715. You owe it to yourself to investigate before investing in *any* lathe.

Lathe Capacities: 17" lathe: 54" and 78" centers, 28" swing in gap; 15" lathe: 30" and 48" centers, 24" swing in gap; 13" lathe: 24" and 36" centers, 18" swing in gap.

CLAUSING DIVISION *Write for Free Literature*
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1801 N. Pitcher St. • KALAMAZOO, MICHIGAN

NAMES IN THE NEWS...

J Paul Jordan, associated with General Electric Co for the past 20 years, has joined Gulton Industries, Metuchen, NJ, as assistant to the president. He will serve in the capacity of scientific coordinator responsible for technical planning on government and company sponsored programs.

W E Ramsden, assistant manufacturing manager at Boeing's Seattle Division, has been assigned responsibility for operations of the manufacturing research, industrial engineering, production control, and manufacturing engineering sections. **H E Hurst,** former factory manager, has been named assistant manufacturing manager, special assignments. New factory manager is **S O Svendsen,** former general superintendent of the tooling unit.

Rene A Vanina has been appointed assistant division manager, sales, of General Dynamics Corp's Electro Dynamic Division at Bayonne, NJ. During his 21 years with the company he has held management positions in engineering and sales.

Eustace Lingle has been named vice president in charge of industrial sales for Oakite Products, Inc, New York. He has been a company vice president since 1953.

George Pekrol has been appointed factory manager of Dollin Corp, Irvington, NJ, producer of zinc and aluminum diecastings.

Robert P Gehring has been appointed sales manager of the Cayuga Machine & Fabricating Co, Depew, NY. Prior to joining the firm Mr Gehring was vice president of the Saginaw Welding Supply Co.

George C Kirker has been named plant manager of the Montebello Division of Western Design & Mfg Corp, Santa Barbara, Calif, division of US Industries. He was formerly chief engineer at Western Gold & Platinum Corp.

George Masurat has been named general superintendent of production for Philco Corp's Government and Industrial Division, Philadelphia. He was previously production superintendent in charge of the Sidewinder missile operations.

Kenneth T Walden has been named head of the Retaining Ring Division of Ramsey Corp of St Louis.

J Mabon Childs and **Stephen F Madden** have been named assistant managers of Firth Sterling's Steel Sales Division. Mr Childs will be responsible for the sale of high speed steel, toolbits, drill rod, ground flat stock, and shank steel. He will continue to manage sales of zirconium alloys. Mr Madden will be in charge of tool and die steel sales, and will continue in his present capacity as mettalurgical engineer.

Eric Eckberg has been named vice president in charge of sales, Union Spring & Manufacturing Co, New Kensington, Penna. **Cornelius A Rauh** has been appointed sales manager of the subsidiary, Biggs Steel Foundry & Fabricating Co, Akron.

Hans M Schiff, formerly works manager of manufacturing of Motorola, Inc, Chicago, has been named operations manager of the Ryan Aeronautical Co plant in Torrance, Calif, recently consolidated with the Ryan Electronics Division.

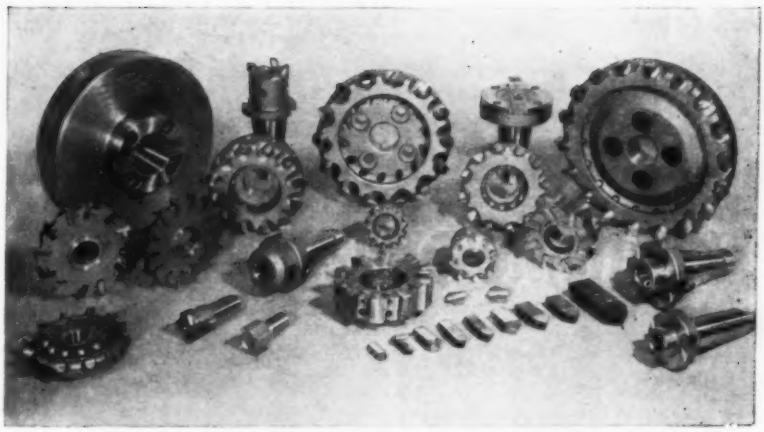
E S Evans has been named engineer in charge of the project section, and **R E Ferber** supervisor of the production planning section of Allis-Chalmers steam turbine department.

Henry C Frost, assistant chief engineer of Corn Products Refining Co, Chicago, has been elected president of the Instrument Society of America. **John Johnston Jr,** supervisor of E I duPont de Nemours' Engineering Service Divisions consultation group responsible for instrumentation system development, has been elected president-elect-secretary, slated to become president of the Society in 1959-60. New vice president of the Society's Standards and Practices Department is **Glen G Gallagher,** principal instrument engineer for Fluor Corp, Ltd, Los Angeles. **Thomas C Wherry,** assistant branch manager of the Instrument and Equipment Laboratory, Phillips Petroleum Co, has been elected vice president of the Society's Technical Department.

William H Armstrong has been elected vice president and general manager of Metal Finish, Inc, Newark, NJ. He was formerly sales manager for the Honite Products of Minnesota Mining & Manufacturing Co.

OBITUARY

Ben D Smith, general supervisor of mechanical engineering research, Manufacturing Research Department of International Harvester Co, died Sept 14.



Milling Cutters — End Mills — Blades — Boring Tools — Arbors — Flywheels

These Lovejoy Products can help you Cut Costs!

The entire line of Lovejoy Milling Cutters and Accessories is designed to aid you in getting better production at less cost.

If you are not now using Lovejoy products, we invite you to do so at first opportunity.

Lovejoy precision-engineered tools include:

Inserted-tooth milling cutters (face, side, end, slotting and boring) which feature husky, forged steel housings; exclusive Lovejoy "positive-locking" blade assembly; a variety of dozens of models and hundreds of sizes.

Blades: H.S.S., Vasco Supreme and carbide. These are interchangeable over a wide range of housing sizes, and Type "A" face milling blades will fit any standard Lovejoy Type "A" cutter of 4½" to 24" dia. All Lovejoy blades are carried in stock, ready for immediate shipment. Special cutters are a Lovejoy specialty.

NEW "JOYDEX"

This performance-proved face mill features indexable blades for low cost-per-edge cutting. Exclusive design improvements include — adjustable anvils • extra deep chip flutes • fast, easy indexing • sweep blades for fine finish • double positive, or combination positive and negative rake angles merely by changing blades • rugged, one-piece body • large locking screws. *Try out a new "Joydex" and prove its superiority! ("Joydex" data sheet is yours for the asking).*

Catalogs — include: "Face Mill Catalog No. 31; Side Mill Catalog No. 32; Type "S" Bulletin; Arbor Catalog No. 33; "Speed and Feed" Calculator. Write today for copies desired.

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BALANCING MACHINES

- Automatic Indications
- Single Knob Control
- Superior Accuracy
- Dependable Quality
- 14 Dynamic and Static Models

Write for detailed information!

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Fast CUTTING-OFF

the Modern Way

TUBING and BAR STOCK

Automatic operation—from loading to final cut-off. Handles tubing up to 8" O.D. Very fast. With special tools, parts being cut off may be formed, grooved, flanged or chamfered in a single operation—at a high rate of speed.

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New catalog describes all models — gives production figures. Mailed on request.

MODERN MACHINE TOOL CO.

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Commander

SELECT A SPINDLE

DUAL SPEED DRILL PRESS TURRET

DRILLS, REAMS, TAPS ON 1 DRILL PRESS SPINDLE!

- **Fits Any Drill Press**
- **Increases Production**
- **Reduces machine, fixture costs**

Commander Select-A-Spindle permits you to do 3 operations on a single drill press spindle . . . save time . . . eliminate multiple handling of piece parts, speed production and reduce overall costs. Dual Speed Select-A-Spindle permits selection of proper speed for each operation. Quick, positive hand indexing positions each tool accurately for sequence operations. Select-A-Spindle is built to tap with any 1, 2 or all 3 spindles to the full capacity of the unit. Adjustable torque control spindles for protection of taps to ¼" available.

Write for illustrated circular on Select-A-Spindle, other Commander Production Tools and name of your nearby Commander Distributor

Commander MFG. CO.

4238 W. KINZIE STREET, CHICAGO

PRODUCT OF COMMANDER . . . BUILDER OF PRODUCTION TOOLS

CIRCLE 318 READER SERVICE CARD

CIRCLE 320 READER SERVICE CARD

Ernest Olds tells how Moore Jig Borer and Jig Grinder Help "Broaden Our Scope of Precision"

This is another in a series featuring the views of leading tool and die companies

by **ERNEST E. OLDS,** General Sales Manager
Size Control Company, Chicago, Illinois
Manufacturers of gages and lapping machines

"We at Size Control Company find it absolutely necessary to broaden our scope of precision to meet the increasing needs of our customers. This calls for holding close limits on location as well as our usual tolerances on diameters.

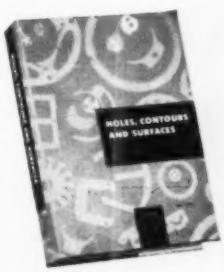
"The Moore Jig Borer and Jig Grinder is our answer! In use, these machines give amazing, practical flexibility to establish extreme accuracy with repeated confidence.

"The Moore Jig Borers and Jig Grinders which we are now using are in a special temperature controlled room. They have held tolerances as close as .00005" with comparative ease. They are used in conjunction with electronic gages, which re-inspect the results of the Borer and Grinder and act as a double-check for accuracy."

In addition to maintaining close tolerances for tooling accuracy, Moore Jig Borers are designed for economical, high-precision production operations. Moore Jig Grinders prove their mettle in the finish-grinding of intricate contour shapes and holes. For literature describing the unique features of both these toolroom time- and cost-cutters, just write...

MOORE SPECIAL TOOL COMPANY, INC.
738 Union Avenue, Bridgeport 7, Connecticut

MOORE JIG GRINDER (left) and Moore Jig Borer team up in this dust-free temperature controlled room at Size Control Company. Under such conditions they have held hole location tolerances to .00005".



HOLES, CONTOURS AND SURFACES, Moore's authoritative book, tells how to produce tools, dies and precision parts *the modern way*. 424 pages, 495 illustrations. $5 in U. S. A., $6 elsewhere.

ADD MOORE TOOLS TO YOUR TOOLROOM

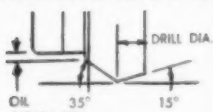
JIG BORERS • JIG GRINDERS • PANTOGRAPH WHEEL DRESSERS • PRECISION ROTARY TABLES • HOLE LOCATION ACCESSORIES

RO
UNIVERSAL FORM RELIEVING FIXTURE
R-O Grinder

NEW! Operator Training Program

don't be sure you're doing these jobs the best and least expensive way—

CHECK ON THE R-O METHOD



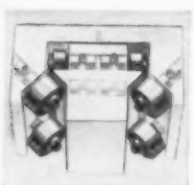
FORM RELIEVING CUTTERS SUCH AS GUN DRILLS

R-O form relief, radial or axial or in any combination of radial and axial as required, leaves maximum metal behind the cutting edge to support it. This, plus grinding from edge toward heel eliminates feathers, giving a keener, longer lasting edge. Cutters are ground from formed wheels faster, too, than by conventional methods.

GRINDING SHAPES SUCH AS PUNCHES

From cams, precision control of motion into the wheel is achieved with near infinite control of the cam drop to permit grinding punches, flats, hexes, ellipses, cams, etc., from the solid to close tolerances. The speed in most cases brings the cost below conventional methods.

HERE'S ONE REASON R-O GIVES YOU PERFECT CONTROL OF THE GRIND



Work moves on plane, maintaining its level to the wheel. Operation is on hardened and ground ways, rolling on 8 precision, preloaded ball bearings.

GRINDER DIVISION
Royal Oak Tool and Machine Co.
29800 Stephenson Hwy., Royal Oak, Mich.

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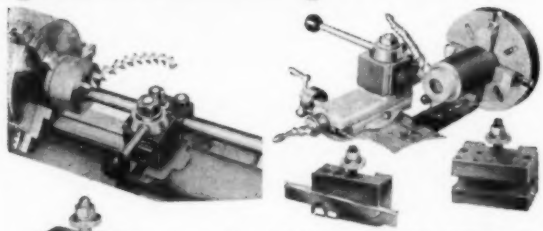
166 CIRCLE 322 READER SERVICE CARD

YOUR LATHES "TURN OUT" BIGGER PROFITS

WITH **ALORIS** QUICK CHANGE **TOOL POSTS & TOOL HOLDERS**



Change tools instantly—for turning, facing, drilling, boring, threading, knurling, cutting off or any operation.

- Maximum Repetitive Accuracy Assured
- No Shims . . . No Time Wasted
- Unlimited Versatility
- Saves 90% Set-up Time, 50% Production Time
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- Leading Lathe Mfrs. Recommend It
- Sizes to Fit Every Lathe
- Unconditionally Guaranteed

NEW! Aloris Holder for Carbide Triangular Inserts.

Greater rigidity, versatility, efficiency & economy

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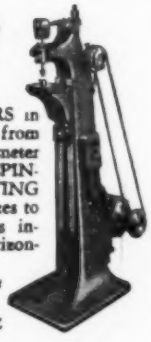

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RANDALL and STICKNEY Dial Gauges and Indicators

are accurate, reliable and built to stand hard usage.

eter, balanced dial 0-25-0 with .0005" Model "C 50 B" has a 2½" overall diam- graduations, ½" range and movable dial easily set at zero.

The cases on all R. & S. Gauges are made from sturdy castings. The case and plate are two separate units so that repairs can be made easily.

This style instrument can be furnished with various dials, graduations and ranges, in both English and Metric. There is an R. & S. Gauge for practically every purpose. Write for circulars describing our complete line.

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248 Ash St
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Makers of Dial Gages Since 1898

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Wire for 10,000 uses

...and we make all kinds

Name your wire requirements—chances are that our wire mills at Johnstown, Pa., and Sparrows Point, Md., are right now producing the very grade you need.

Whether it's low- or high-carbon wire, bright basic or annealed, galvanized or bethanized . . . we pay the closest attention to all the important details that mean top-quality steel wire.

Working closely with users of steel wire, we have developed various specialties for specific end uses. Our engineers will gladly discuss steel wire with you, whether you need an ordinary grade or something special. Just get in touch with the district sales Bethlehem office nearest you, or write to us direct.

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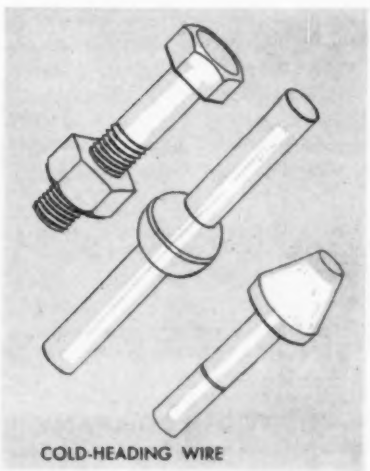
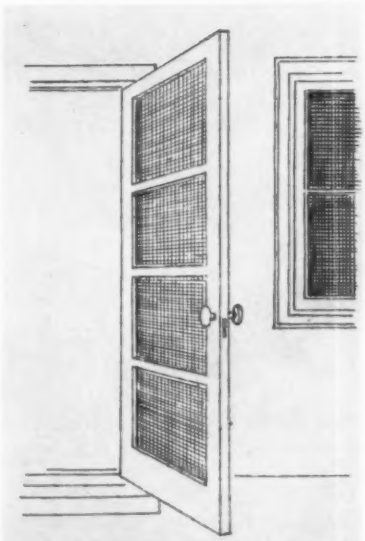
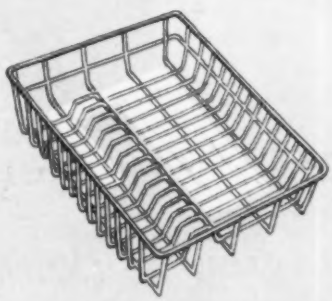


COLD-HEADING WIRE

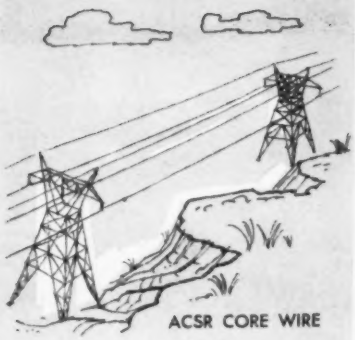


LIQUOR FINISH FLY SCREEN WIRE



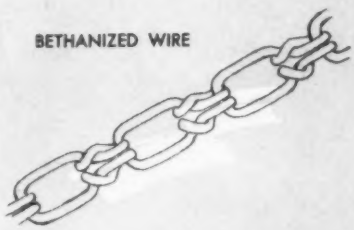
BRIGHT BASIC WIRE

COAT HANGER WIRE



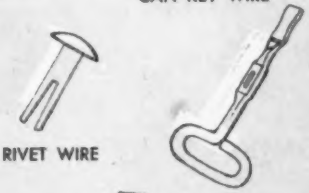
ACSR CORE WIRE

SILVER STAR SPRING WIRE

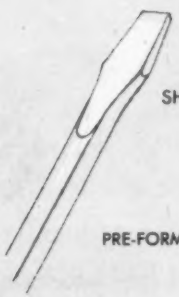


BETHANIZED WIRE

CAN KEY WIRE



RIVET WIRE



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BETHLEHEM STEEL

BETHLEHEM STEEL

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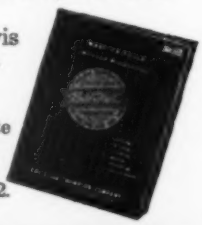
. . . with Davis & Thompson **Roto-Matic** *and Automatic Ejection*

Here's another example of Davis and Thompson Engineering of high production with a minimum of equipment. This GG-8 horizontal threader is equipped with 4 spindles in each head and a 4 station fixture. It is one of countless threading machines that have been designed and built by Davis & Thompson since 1924. Both single and double end machines for pipe, conduit, shafts and similar parts in various production quantities have been produced.
If you have work of this nature, call in a Davis & Thompson Representative. There is no obligation for this service.



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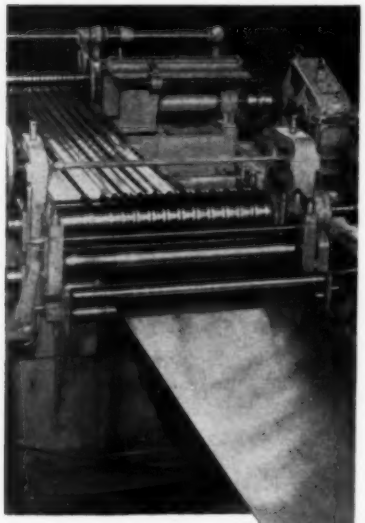
From the *American Machinist* Library of *Tips for Top Shop Men*

STUDY merchandising's technique for introducing a new product. It'll pay you to try the same methods when installing new equipment. You'll avoid resistance not only from workers but also from foremen.



Greater Profit and Operational Flexibility with a YODER SLITTER

Even if you use less than 100 tons of varied strip sizes per month, it will pay you to investigate the savings that are possible through the operation of a Yoder slitter. Savings per ton increase rapidly as coil size and width of strands decrease...so much, that under average operating conditions, a slitter will pay for itself in a few months.

From a small stock of standard mill-width coils, a Yoder slitting line enables you to meet unexpected demands, or to supply "special" width slit strands in a matter of a few hours. This flexible operation increases plant efficiency, resulting in savings of time and money through simplified production planning and greatly reduced strip inventories.

The Yoder line includes slitters of every size and capacity for coil or sheet stock. Send for the all-new, 1958 edition of the Yoder Slitter Book. It is a comprehensive text on the mechanics and economics of slitter operations with time studies, cost analyses, and other valuable data. Write to:

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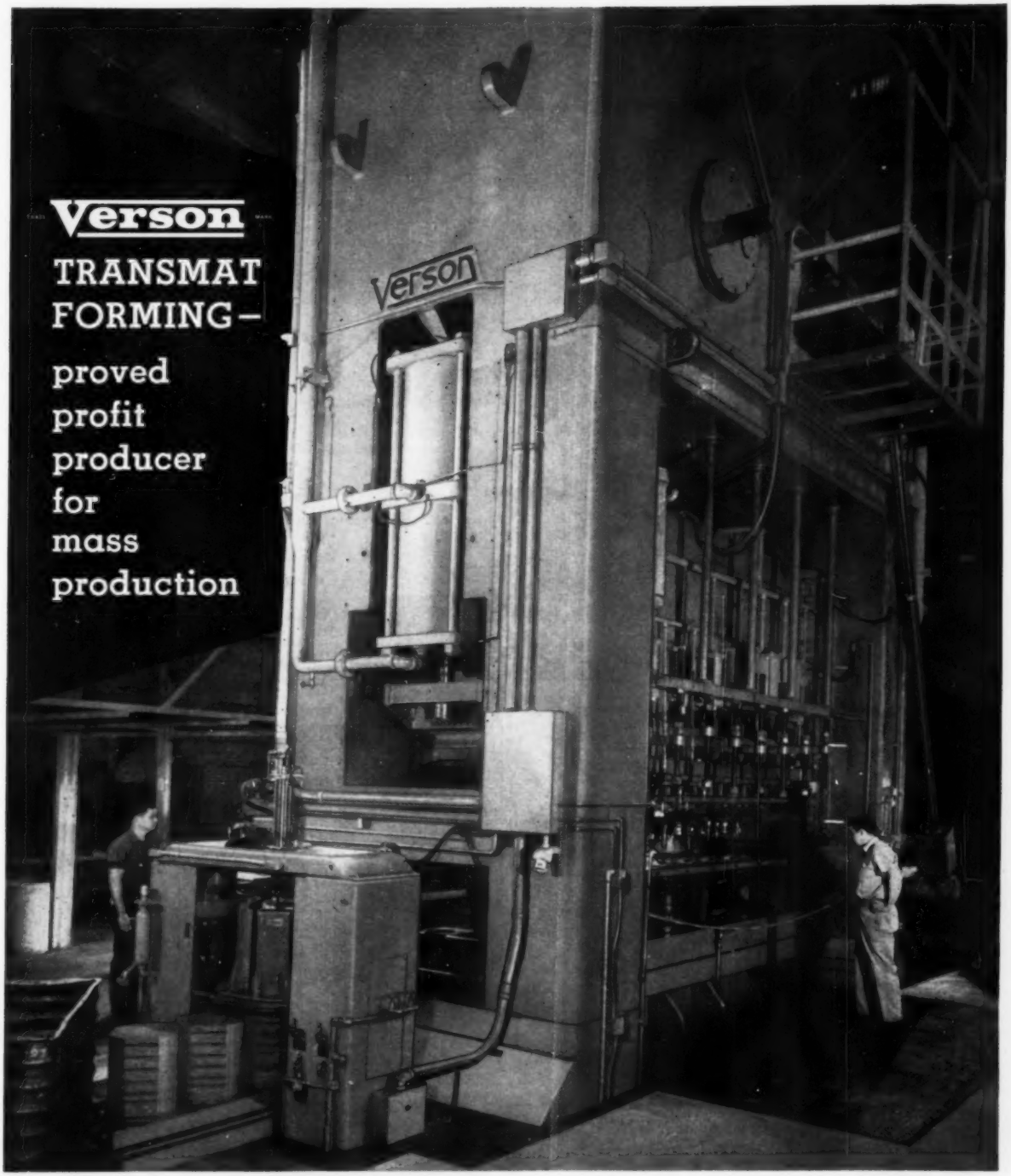

If the squeeze on profits is hurting you, it is time to consider Verson Transmat Forming for any stampings you must produce in quantity. For twenty years the Verson Transmat Process has been proving itself a real profit builder on stampings of virtually all sizes and shapes.

This press at Kelsey-Hayes Company is a good example of what Transmat forming can do. It produces complete automobile wheel spiders in seven operations without intermediate handling, pickling or annealing. Operating speed is 18 strokes per minute, with a finished spider discharged at each stroke.

Talk over your quantity stamping requirements with Verson engineers. Their cost conscious approach to your problems pays off in better returns to you. Write or phone, today.

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Mechanical and Hydraulic Presses and Press Brakes • Tooling
Die Cushions • Verson-Wheelon Hydraulic Presses

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MUCH MORE - for LESS!

with *Cleveland*

ROUGHNESS METER

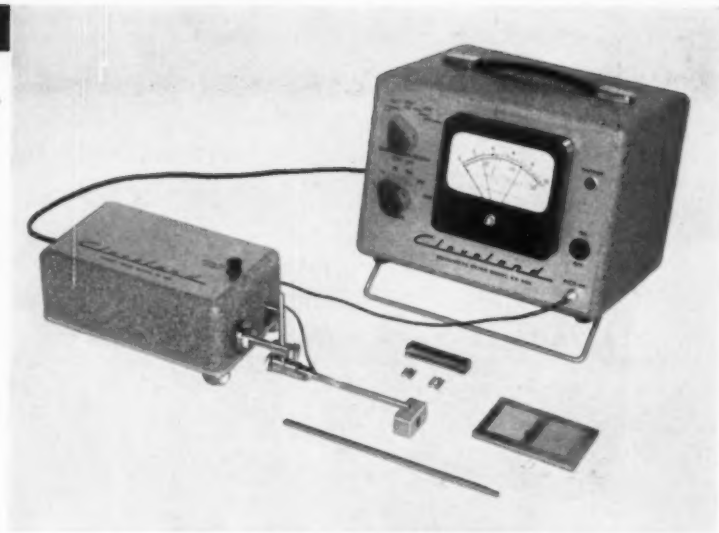
The Roughness Meter was designed to do more than any other surface measurement instrument at a price within the range of any budget.

More VERSATILE—with less equipment you can measure the widest range of surface shapes—outside diameters down to .030"—inside diameters as low as .25".

More ACCURATE—less arguments. Precision calibration and construction exceeds all military and industrial standards.

More VALUE—lower cost. You will save from 35% to 100% over the cost of comparable equipment.

More CONVENIENCE—less confusion. The easiest to operate. Clearly marked controls, skids, adjustable tolerance hands.



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IT'S PLAIN TO see

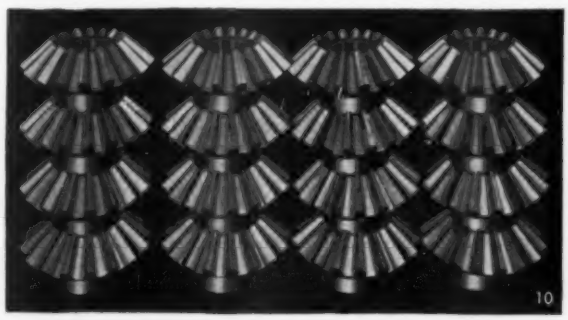
A Boring Head That Won't Face is NOT Complete

NOW you can get a boring head that will BORE, FACE, TURN and GROOVE at no more cost than you would pay for a plain, single purpose boring head.

LOOK INTO THIS before you buy that new head. Write for full details.

CHANDLER TOOL CO.
Muncie, Indiana, U.S.A.

Chandler-Duplex
COMBINED BORING AND FACING TOOLHEADS



Pattern of PRECISION . . .

Accuracy in quantity is yours at Stahl Gear, as exemplified by these steel mitres scheduled for use in the steel industry. Specifications were met EXACTLY and PROMPTLY—13.931" O.D., 4" F., 1¼ D.P., deep case-hardened for long life. Stahl-built means precise fit and long, trouble-free performance. Get our estimate.

SPURS TO 72" PD. 1 DP
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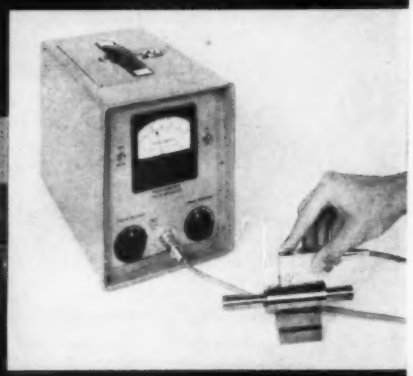
Profilometer parts turned on RIVETT 1020S require no rework –save production time!



Profilometer manufactured by Micrometrical Manufacturing Co., Ann Arbor, Michigan.

Rivett 1020S Toolroom Precision Lathe in use in toolroom of Micrometrical Manufacturing Co., Ann Arbor, Michigan.

Micrometrical is famous as a manufacturer of precision instruments, such as the Profilometer, designed to measure surface roughness in millionths. Micrometrical highlights an important Rivett feature in its statement:

"Because of its construction and weight, the Rivett 1020S Lathe has very little vibration, making it ideal for close tolerance work.

In time of need, during peak work loads, the Rivett is often used on short-run production work, especially on intricate and complicated parts requiring extremely fine finishes as measured with the Profilometer."

RIVETT

"Steelway" Lathes

Inquire about the 1020S Toolroom Precision Lathe now. Write for 16 page catalog and the name of your nearest dealer.

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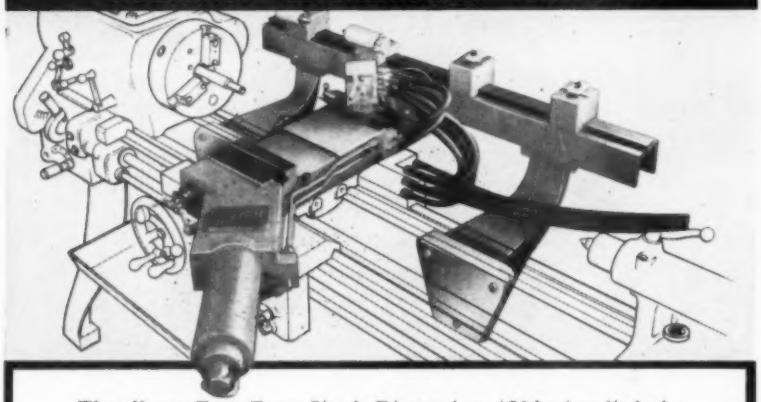

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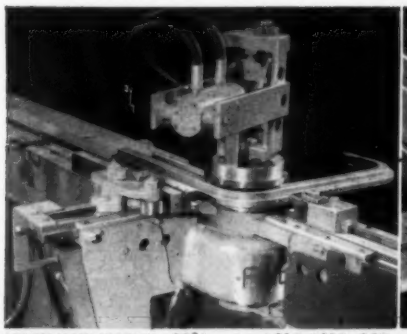
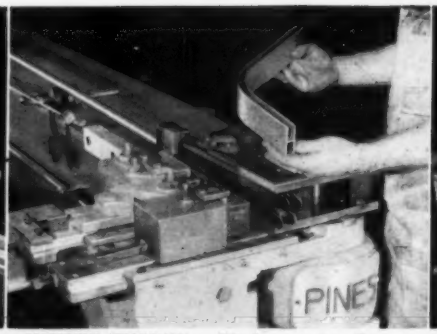
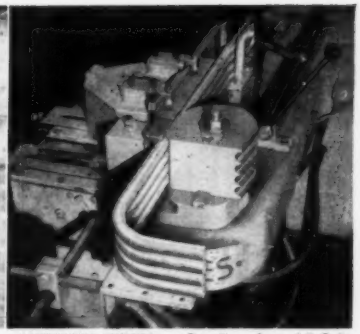


ROLLED-STEEL SECTION—90° bends in 1¾"x1¾"x.059 stock produce automobile seat frames. Split dies with automatic actuator make possible speeds up to 500 bends per hour.



ALUMINUM EXTRUSION — Window awning ribs are accurately formed on a 5¾" inside radius using leaf-spring mandrels. Split-die tooling speeds loading and unloading operations.



ALUMINUM TUBING — Bending four 1" O.D. x .035 workpieces simultaneously on a 3½" CLR produces up to 1200 pieces per hour for large furniture plant.

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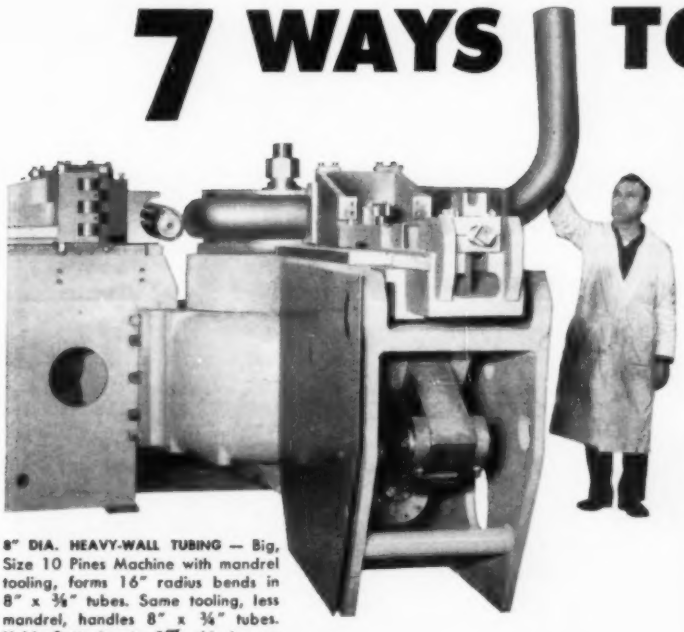

8" DIA. HEAVY-WALL TUBING — Big, Size 10 Pines Machine with mandrel tooling, forms 16" radius bends in 8" x ⅜" tubes. Same tooling, less mandrel, handles 8" x ¾" tubes. Holds flattening to 8%, thinning on outside to 10%.

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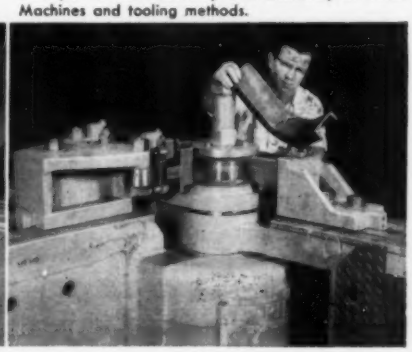

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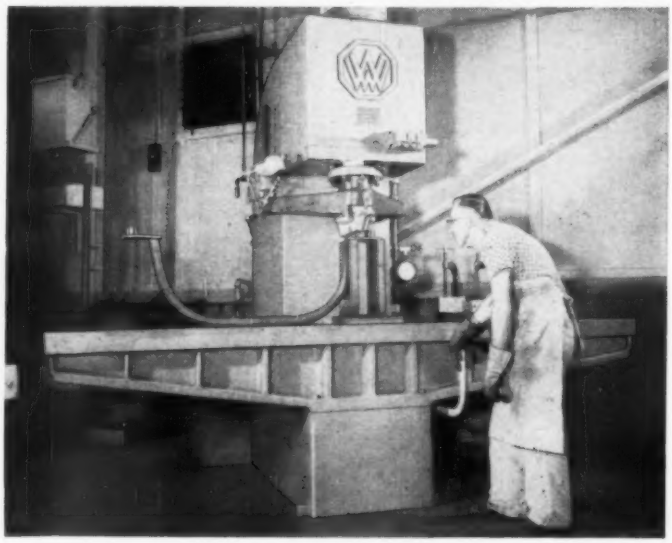

The press illustrated has 100 tons capacity, 120" x20" removable table, 20" daylight and 16" stroke. It is located in a plant of North American Aviation, Inc.

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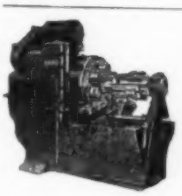
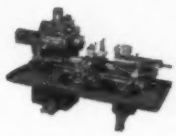
Automatic for bar work. In exceptionally fine condition, new 1944, used very little, well equipped.



No. 76H BAIRD 6-Spindle

7" capacity Auto. Chucker. New 1950. Serial #473. With additional H.D. vertical slide.

No. 4 WARNER & SWASEY



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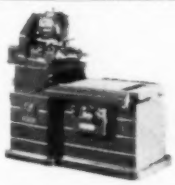
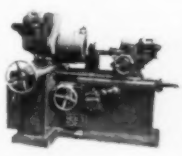


Two—112C EXCELLO

Single End Boring Machines, serials 5953 & 5954, new in 1952. Very latest type. With DB22 or DB24 boring heads.



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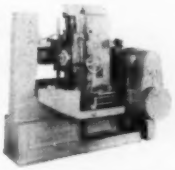

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Surface Grinder with power down feed, hydraulic in and out, 15 H.P. spindle motor, auto. wheel truing, 12" wide

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3'11", 3'x13", 5'x15" Cinc.-Bickford Super Service Motor on Arm. Radial Drill.

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No. 2 Bardons & Oliver Ram Type Electric, m.d.
No. 2L Gisholt, 1943
No. 2A Warner & Swasey, 1946
No. 2HS Libby, 1942
No. 3 Gisholt, m.d. 1945
No. 3A Warner & Swasey, m.d.
No. 3 Bardons & Oliver Ram Type, flanged m.d.
No. 3L Gisholt, m.d., 1943
No. 3AL Gisholt, with cross sliding turret, 1940
No. 4 Midland Universal Ram Type, m.d.
No. 4 Warner & Swasey Universal Ram Type, m.d.
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GRINDERS, C'LESS No. 12 Landis, 1947
GRINDERS, CYL., 4" x 12" No. H Landis, 1943
GRINDERS, UNIV. 14"x14" Mod. 112 Rivett, 1942
GRINDERS, CYL. 20" x 72" Landis, 1943
GRINDER, INT. 72A5 Heald, Univ., Hydr.
GRINDER, INT. No. 74 Heald Hydr., plain, 1941
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GRINDER, SURF. 14" x 40" Mattison, 1942
GRINDER, SURF. 20" and 24" No. 25A Heald
GRINDER, SURF. 36" No. 16 Blanchard, 1940
GRINDER, CUTTER, 30" Ingersoll, 1942
GRINDER, CARBIDE, Nos. 48 & 49 Excello, 1941
GRINDER, RADIUS, No. 49 Van Norman, late
GRINDER, TOOL & CUTTER, No. 2 Cincinnati
HOB SHARPENER, Type HRS Barber Colman
KELLER, BL2416 Pratt & Whitney 3 Spdl., 1941
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LATHES, ENGINE, 13", 15" & 17" LeBlond Regals, new
MILLER, AUTO, 48" No. 33 Sundstrand
MILLER, HAND, No. 2RV Kent-Owens, 1942
MILLERS, No. 10 & 3 Van Norman Duplex
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MILLER, PLAIN, No. 2 Cincinnati
MILLER, VERTICAL, No. 2 Brown & Sharpe, 1943
MILLER, No. 36 VanNorman, ram type 1942
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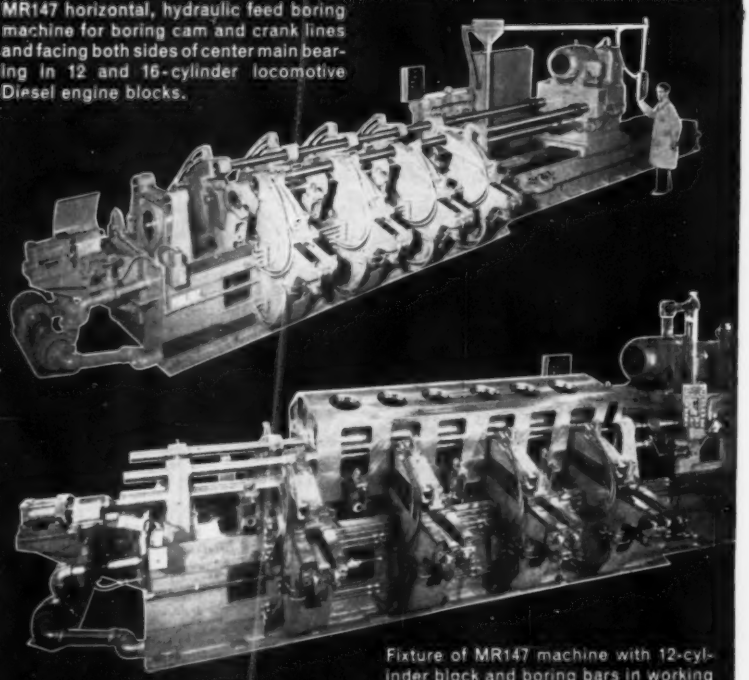
MOLINE

MR147 horizontal, hydraulic feed boring machine for boring cam and crank lines and facing both sides of center main bearing in 12 and 16-cylinder locomotive Diesel engine blocks.



Fixture of MR147 machine with 12-cylinder block and boring bars in working position. Cam bars run in hydraulic powered bushings which are retracted when loading fixture.

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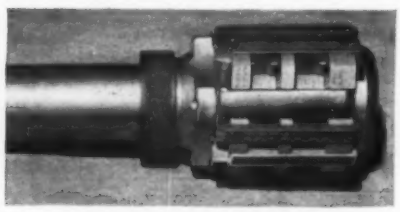
WHY MICROHONING* TOOLS ASSURE

ECONOMY — PRECISION — PRODUCTION

COST FACTORS (labor, maintenance, scrapped parts, productivity, etc.) DETERMINE MACHINE TOOL EFFICIENCY.

To Minimize These Cost Factors, Micromatic has developed Microhoning tools that offer a new concept in metalworking. This concept (known as the Microhoning process) assures controlled abrading, efficient stock removal, accurate generation of geometry and size, and produces uniform, functional surface finishes.

Because Microhoning removes inaccuracies of preceding operations, it is usually the final stock removal operation. Therefore, Microhoning tools are designed and applied to produce high precision, assure a minimum of scrap and protect the user's investment in previous processing operations.



New! Tru-Float tool has a universal joint within the abrading unit. This design provides maximum accuracy and float, uniform abrading and surface finish, less wear of abrasives, retention of original bore location, and minimum stock removal to correct inaccuracies.

Micromold assemblies have plastic or soft metal shells that minimize tool wear and protect the edges of abrasive sticks from the harsh dressing action of extremely rough bores. This abrasive stick design eliminates many parts previously required to hold abrasives and expand the tool.

Tool designed for Microhoning tandem bores has plastic guides between banks of abrasives to stabilize the tool as it passes over bore interruptions.

Because use of the proper tool is so important, Micromatic designs Microhoning tools to suit the individual work piece, and integrates tool design with machine and fixturing to provide the ultimate in operating efficiency.

*Registered U.S. Pat. Off.

MICROMATIC HONE CORP.

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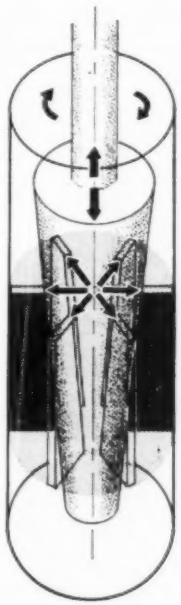
HOW MICROHONING* TOOLS PROVIDE

ECONOMY—PRECISION—PRODUCTION

When a precision stock removal process minimizes cost factors (labor, maintenance, scrapped parts, etc.) then volume production at lower cost per piece is possible. Here's how the distinctive design and performance of Microhoning tools provide all three—economy, precision and production.



EFFICIENT OPERATION

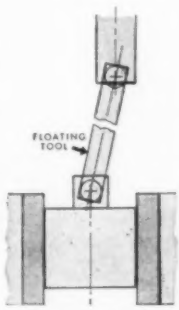
Micromatic expands, rotates and reciprocates the abrading tool in the bore. Through this controlled combination of pressure and movements, abrasives are self-dressing for effective and continuous cutting action. Long abrasive sticks are evenly spaced around the tool to keep it stable. They effectively bridge surface irregularities and generate a geometrically true cylinder.

REDUCES OPERATOR COSTS

Micromatic "Adjusting Heads" give operator complete and positive control of tool expansion. Or, automatic controls can be used to perform all tool adjustment and gaging. They assure accurate duplication in every part produced.

MINIMUM MAINTENANCE

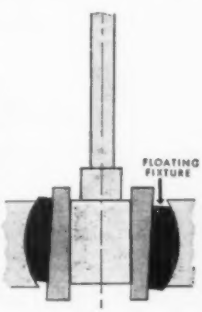
Micromatic tools are designed for durability, especially at all stress points and joints. Plastic or soft metal holders prolong abrasive life, greatly reduce tool wear.



MAINTAINS ORIGINAL BORE LOCATION

Micromatic either floats the tool or the work holding fixture so tool and work piece can automatically align themselves. This assures cutting-unit rotation coincides with neutral axis of bore.

WRITE FOR LITERATURE



Micromatic produces tools best suited to the production of individual work pieces. And properly integrates the tool with machine and fixturing for peak productivity at lowest cost per piece produced.

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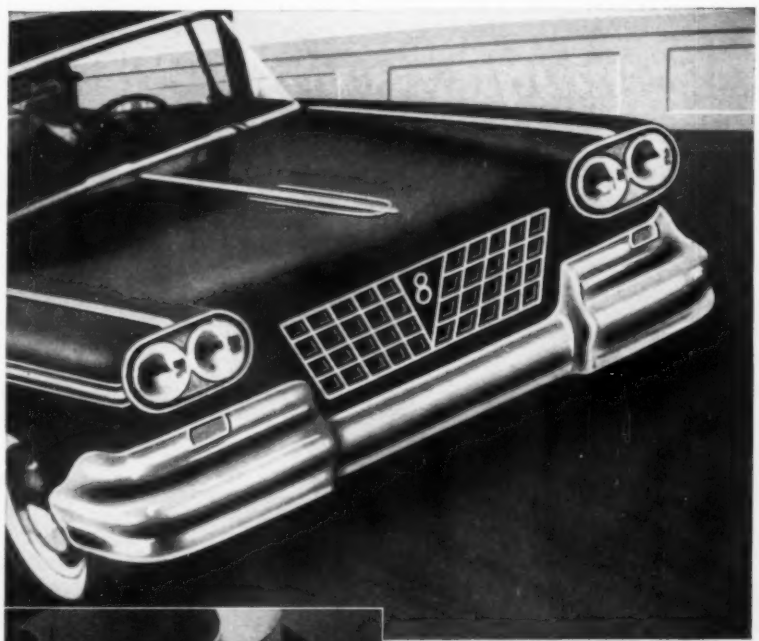

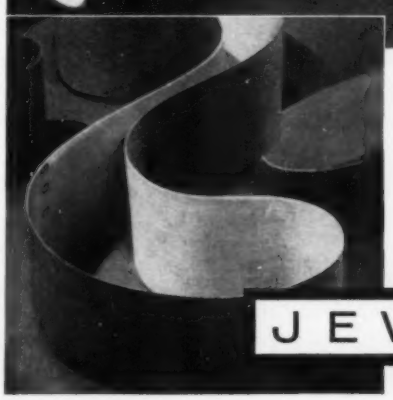

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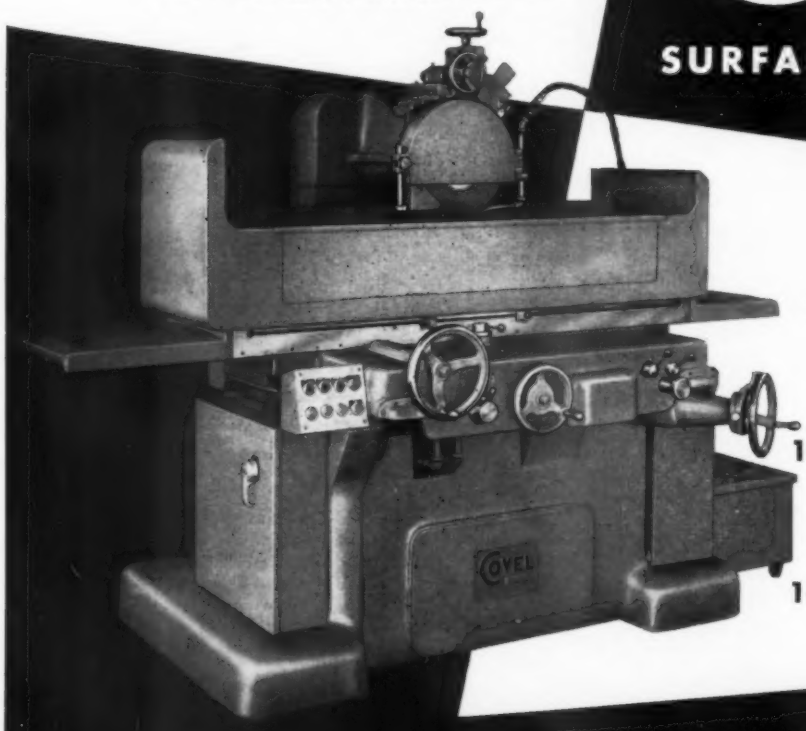

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